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Interconnected networks

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Interconnected networks[*]

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Executive summary

1. Market research by competition authorities in countries with CPP ('calling party pays') regimes indicates that wholesale call termination on a single mobile network can be defined as a relevant product market, and on such a market, an operator has 100% market share. Mobile operators face no (or very little) competitive pressure in the wholesale market for call termination.

2. The root cause of these 'call termination monopolies' is the CPP regime, which gives rise to an externality: mobile operators can charge operators in the fixed market – instead of charging customers in the market in which they compete – for the termination of incoming calls from fixed subscribers. Fixed operators' access charges are usually regulated (at 'cost-oriented' levels) so that they do not have countervailing bargaining power in the wholesale market for termination access.

3. Intense (or even perfect) competition in the mobile retail market does not provide a reason to conclude that the call termination monopolies can be ignored by regulators and competition authorities. Even if termination profits are passed on to mobile customers (in the case of perfect competition: up to the point where each operator makes zero overall profits), welfare may be distorted.

4. Mark-ups in mobile access prices stemming from call termination monopolies tend to inflate per-minute prices for off-net calls, especially for fixed-to-mobile (F2M) calls. This distortionary effect on retail prices is more severe when fixed and mobile markets are more 'distinct', that is, when there is a larger number of fixed users who are not customers in the mobile market but do make calls to mobile users. Therefore mobile access mark-ups effectively create a net money stream from the fixed to the mobile sector, subsidized by fixed subscribers who call mobile users. The problem in the mobile-to-mobile (M2M) case tends to be less severe, since the effects of access mark-ups cancel out to some extent (in a more symmetric market, charging each other for call termination

makes much less sense, since access mark-ups would only lead to pumping around access revenues).

5. The presence of call termination monopolies does not automatically imply that there is an overall welfare problem. On the one hand, (i) per-minute prices for F2M and off-net M2M calls are inflated, distorting the demand for these calls; and (ii) consumers who pay inflated prices subsidize consumers who benefit from handset subsidies or reduced mobile subscription fees, so that there may be overconsumption of mobile services (e.g. an inefficiently high turnover of phones by consumers). On the other hand, (i) access mark-ups may efficiently contribute to the recovery of fixed and common costs; and (ii) assuming that competition in the mobile retail market is sufficiently effective, mobile consumers benefit since overall mobile telephony becomes cheaper, an effect that contributes to fast market expansion. The net welfare effect is unknown (and hard to assess).

6. If operators have to recover fixed and common costs of their networks, then Ramsey pricing (by definition) leads to a second-best welfare outcome (compared to the first-best outcome in which investments are covered by a lump-sum transfer from the government). A proper welfare analysis to derive Ramsey prices should include both the fixed and mobile market, each of them both at the retail and wholesale level. Whether the resulting pricing structure requires substantial mark-ups in mobile access prices is uncertain, in particular since they undermine the effectiveness of cost recovery through alternative, potentially superior instruments, such as subscription fees. Moreover, partial price controls with Ramsey elements (e.g. setting only mobile access prices but not fixed access prices at Ramsey levels, or leaving retail prices to be determined by competition) may not lead to a second-best welfare outcome.

7. The current policy tendency is to restrict attention to the defined market, establish substantial market power (a dominant position), and regulate the prices in question. A shortcoming of this approach is that it is not based on an overall welfare analysis. Also, it is transitory only to the extent that regulators will have to continuously monitor whether

the ‘single network’ market definition has ceased to be valid, and if yes, withdraw the price controls. Thus a possible consequence is that regulatory intervention becomes a semi-permanent phenomenon, rather than a one-shot intervention that creates a fundamental change in the market. Overall, the strong focus on price controls that is observed in practice is hard to justify from a welfare perspective.

8. Compared to price controls, there exist alternative, less heavy-handed, ways to intervene, which are directly aiming at the root cause of the problem and can make access regulation unnecessary.

- First, as an eye-opener, consider the elimination of the regulatory asymmetry between the fixed and mobile sector, for instance by creating countervailing bargaining power for the fixed operator in the wholesale access market (while verifying that fixed end-users benefit from lower access mark-ups through reduced retail prices). Although this type of remedy may ultimately not be be feasible as regulators may be unwilling to deregulate fixed termination access, it points at the connections between the fixed and mobile sectors in relation to call termination monopolies.
- Second, a remedy is to introduce RPP (‘receiving party pays’), that is, change the commercial agreements such that the price for receiving calls is not a priori fixed at zero because of some convention, while the calling party still pays a price for call originiation. This remedy can be implemented straightaway but requires regulatory intervention (to make it happen).
- Third, an option is to introduce ‘call termination bypass’ by making it technically feasible that alternative mobile operators can deliver calls to other operators’ customers (e.g. on the explicit request of calling parties, for instance by dialling a ‘Carrier Select’ prefix). The latter solution may not be immediately feasible or desirable though, given the current state of network technology.

9. Remedies should always be compared to the possibility of refraining from intervention. Arguments in favor of laissez-faire are: (i) the cross-subsidy from the fixed to the mobile sector, which might be the most significant effect of call termination monopolies, are offset by the fact that most fixed customers also own a mobile phone, so that overall they may hardly be affected; (ii) changes will not lead to Pareto-improvements, as users and/or operators in the mobile sector will lose, regardless of the way in which F2M termination tariffs are reduced; (iii) mobile operators paid money for their licenses, arguably on the expectation that they could recover (part of) it with F2M termination charges – changing the rules of the game could be considered a regulatory taking; (iv) we do not yet have a good understanding of how CPP versus RPP may affect social interactions and how the two regimes are valued by consumers; and (v) call termination termination may become viable in a few years, so there is no need to introduce structural reforms now. Perhaps except for the first one, these arguments are not very strong: (ii) one cannot realistically expect Pareto-improvements to be a requirement for regulatory intervention; (iii) even though regulatory takings may pose a serious risk for firms, licence-holders can realistically expect that competition authorities and regulators are 'obliged' to deal with major market failures; (iv) the potential negative effects of a switch to RPP seem to be of minor importance; and (v) without external pressure, operators will not have incentives to develop the technology for call termination bypass.

10. The net welfare effect of access mark-ups due to call termination monopolies is unknown, but clearly call behavior is distorted as a result of inflated per-minute prices for off-net calls. If any, forcing mobile operators to apply RPP instead of CPP is a straightforward and simple remedy, as it instantaneously eliminates the root cause of call termination monopolies.

11. To conclude, the current focus on price controls to deal with call termination monopolies is understandable within the context of the regulatory framework in the EU, but it ignores important elements of the broader picture and therefore risks to be misguided from a welfare viewpoint. Such an approach may eliminate the symptoms at a local level (namely within the narrowly defined market where an abuse of market power

is established), but it lacks a welfare diagnosis that looks at the root cause of the problem, which happens to be an externality that goes beyond the ‘relevant’ market of wholesale call termination on a single mobile network.

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Preface

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1. Introduction

Following the liberalisation of telecommunications markets, the ability to interconnect has become an essential prerequisite for successful market entry by new telecommunications operators, whether fixed or mobile. In connection therewith, incumbent fixed telecommunication operators have generally been put under relatively heavy regulatory obligations.[1] In contrast to fixed operators, mobile operators have not been under similar obligations so far. Mobile operators have traditionally been presumed to be subject to vigorous competition. They were not considered generally as possessing market power. Moreover, their services were seen as a luxury which further reduced the incentive to regulate.[2] However, with the explosive growth and development of the mobile markets, these assumptions have been challenged.

In many countries, the number of mobile users and the call traffic that they generate have demonstrated steady growth during the last five years. In the European Union, the number of mobile subscribers increased from 69 million in 1998 to 306 million in 2003, and the average penetration rate increased from 18% in 1998 to 81% in 2003.[3] In particular during the late 1990s, new customers contributed to rapid growth of second-generation ('2G') mobile markets. At present, while growth rates have levelled off and operators have necessarily become more interested in customer retention than market expansion, European markets have started their transition to the third generation of mobile technology ('3G').

The declining growth in mobile markets, the unprepossessing financial positions of several operators resulting from the 3G auctions, and the need for capital to roll out UMTS networks, have increased the pressure in the mobile industry to generate cash.

[1] Markets for fixed telephony are not yet sufficiently competitive (former incumbents still have 'significant market power').

[2] Intven et al. (2000, ch. 3, p. 33).

[3] European Commission (2003b).

Mobile operators try to make revenues across the whole range of services that they offer. One of these services, 'termination access' or 'terminating access' to mobile users, has come under close scrutiny recently from regulators and competition authorities alike.

If a subscriber to one network wants to call a subscriber to another network, the two networks must be 'interconnected', so that the first user can reach the other one. The operator of the user initiating the call has to purchase termination access from the other network in order to complete the call. The key policy issue concerns the level of wholesale prices that operators charge for this service, known as termination access prices. In a number of countries it has been noticed that, while other interconnection rates had steadily declined, the fixed-to-mobile termination access rates had remained at high levels, exceeding by far the rates for mobile-to-fixed or fixed-to-fixed interconnection and, arguably, the costs of providing interconnection.

Several regulators have assessed the reasonability of mobile termination access prices. In a nutshell, the typical reasoning is as follows. Calling parties, instead of receiving parties, pay the price of calling a mobile phone. This arrangement is known as the 'calling party pays' (CPP) principle: the subscriber making a call – not the one receiving it – pays for it (this regime is typically applied throughout Europe). Furthermore, the calling party, when making a call, cannot change or influence the receiving party's choice of subscription, nor does he have an alternative when making a call. Fixed operators' access prices are typically regulated, so they do not have countervailing bargaining power in the wholesale market for termination access. Therefore, mobile operators can exercise monopoly power with respect to call termination on their networks.[4] While operators' costs have decreased and call volumes have increased, it is believed that termination charges have not been reduced in line with efficiency gains, so that consumers have not benefited from cost reductions.

[4] This would also be the case for fixed operators if their termination charges were not regulated.

In the United Kingdom, for example, Oftel had proposed in 2001 to put a price cap on the termination access price, in order to protect consumers. Because the operators rejected Oftel's proposal, it was subsequently referred to the Competition Commission (CC). The findings of the CC supported Oftel's claim that mobile operators had monopoly power and significantly overcharged consumers for connecting calls to their networks. As a result, Oftel recommended substantial, stepwise reductions: an initial cut of 15% and further cuts of the same percentage in each year for the next three years. Three mobile operators (Vodafone, T-Mobile and Orange) lodged an appeal with the High Court to have the proposals overturned, which was rejected by the court. In order to implement the new EU Communications Directives, Oftel published a consultation document on wholesale call termination that included proposals for defining markets and imposing conditions related to significant market power (SMP) on mobile operators.[5] Ofcom, the successor of Oftel, concluded that each mobile operator has SMP in the market for wholesale call termination on its individual network.[6]

The Netherlands provides another illustration. Telecoms and post regulator OPTA and competition authority NMa have jointly investigated termination charges for fixed-to-mobile calls. The NMa (2002) had already determined that there exists a relevant market for termination services for each operator, and that there is no significant competitive pressure on the tariffs for call termination.[7] At a certain point, the NMa decided to use competition law (abuse of dominant position) as a basis for intervening. In the light of these developments, the Dutch mobile operators 'voluntarily' offered to lower their mobile access tariffs, whereupon the NMa terminated its case.[8] The proposed stepwise reduction of these charges came into effect at the start of 2004 and will ultimately lead to a decrease of almost 50% in two years time. According to OPTA, the benefits for fixed

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[5] *Review of mobile wholesale call termination markets*, Oftel, 15 May 2003.

[6] *Wholesale Mobile Voice Call Termination*, Statement, Ofcom, 1 June 2004.

[7] OPTA held a similar view ("Policy rules regarding the regulation of mobile terminating tariffs", 28 March 2002, OPTA/IBT/2002/2200802).

[8] See "OPTA en NMa: bellen naar mobiel wordt fors goedkoper", Press Release (5 December 2003), available at www.nmanet.nl.

callers who call mobile users will account at least to € 200 million in 2004 – effects on other consumers (in particular mobile subscribers) are not mentioned.[9]

The following table exhibits access prices and rough guesses of mark-ups in the Netherlands, as well as the stepwise reduction of access prices that the mobile operators have agreed upon (not all of the proposed steps are included in the table).[10] Although the numbers may be different, the range and order of magnitude of the mark-ups may be representative for other countries as well. As cost data is virtually inexistent, the marginal cost levels reported in the table are somewhat speculative.

Operator	**Marginal cost of access**	**Access price in 2003**	**Mark-up in 2003**	**Access price per 1-1-2004**	**Access price per 1-12-2005**	**Mark-up in 2005**
KPN Mobile, Vodafone	approx. 5-10 cents	18.9 cents	approx. 89 - 278%	15.5 cents	11.0 cents	approx. 9 - 55%
Orange, Telfort, T-Mobile, Tele2	approx. 5-10 cents	21.3 cents	approx. 113 - 326%	17.5 cents	12.4 cents	approx. 19 - 60%

Table 1.1: Access prices, costs of access and mark-ups in the Netherlands (prices are per minute and in €).

[9] Press release "OPTA en NMA: bellen naar mobiel wordt fors goedkoper", OPTA, 5 December 2003. The underlying document "Mededeling inzake beleid OPTA ten aanzien van mobiele terminating tarieven", OPTA/IBT/2003/204693, does not provide further details.

[10] Marginal costs are estimated by the notion of 'long-run incremental cost' (LRIC). Mark-ups are defined as (access price – marginal cost) / access price. The estimates of marginal costs are in line with some experts' views, or perhaps somewhat overstated (private communication).

Table 1.1 suggests that the margins from call termination are very high. In itself this does not imply that there is a competition problem or that welfare is reduced. The immediate policy concern is the supposed presence and exploitation of (excessive) market power.

Another example, in line with the data in table 1.1, comes from Australia, where the competition watchdog ACCC (2004) observed that mobile access prices appear to be at least twice as high as the underlying cost of providing the access service, based on observations that the average access price is 22.5 cents (Australian dollars) per minute while the cost of access is estimated between 5 and 12 cents.[11] To deal with these mark-ups, the ACCC made a 'declaration' of the mobile termination access function, which creates a requirement for the suppliers of the service to provide it, upon request, to other firms at a quality similar to that which the supplier provides to itself. The access price can be determined through commercial negotiations; if they fail, the ACCC can make an arbitration decision. The declaration was based on the view that all mobile operators have market power to terminate F2M and M2M calls on their network and have the ability to set mobile access prices above its underlying cost.

The central question that is addressed in this report is the following one. *Do mobile operators have (and exercise) monopoly power with respect to call termination, and if so, can this be seen as a market failure, and is regulatory intervention desirable?* We will adopt a welfare-perspective to address this question. We remark that the question is complicated by the presence of a segment of fixed subscribers, which is (to some extent) separate from the mobile market. Competition among mobile operators to attract

[11] According to the Australian competition authority ACCC (2004), the 'total service long-run incremental cost' (TSLRIC) of call termination is in the range of 5-12 cents per minute (roughly 3-7 €-cents), which includes a normal return on investment. If one includes a a contribution to common organization-level costs, the cost range becomes 10-17 cents (roughly 6-10 €-cents).

customers may therefore be intense, while there is little competitive pressure with regard to the access charge for incoming calls.[12] [13]

The policy debates on mobile call termination are particularly heated because of the apparent importance of revenues from incoming calls for mobile operators. The declining growth in mobile markets, the unfavorable financial positions of several operators resulting from participating in 3G auctions, and the need for capital to roll out UMTS (the European standard for 3G) networks, have increased the pressure in the mobile industry to generate cash. Given the current business models in mobile telecoms, it may even be the case that mobile operators need the termination revenues to keep their business afloat.

The structure of the rest of this report is as follows. Chapter 2 provides relevant information. In order to provide some perspective, section 2.1 gives an overview of recent market developments. Section 2.2 gives a description of the technologies of fixed and mobile telecommunications. It introduces the reader to common terminology and provides basic explanations of network interconnection and access to networks. Also, ti contains a short overview of different access situations, namely one-way access and two-way access. Chapter 2 can be skipped by readers who are familiar with telecommunications technology and market developments.

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[12] Early papers that define the relevant issues within the Dutch context and provide some first suggestions for dealing with the 'problem' are Haan (2002) and Van Damme (2002).

[13] Armstrong (2002) coined the term 'competitive bottlenecks' to describe the situation in which several networks compete for the same pool of customers, while network operators have monopoly power in the wholesale market for call termination to their customers. The problem of monopoly power (or its supposed presence) with regard to call termination does not only occur in mobile telecommunications markets, as it is also present in fixed telecoms. An example outside of telecoms is Internet. Consider a consumer subscribing to a certain Internet service provider (ISP), who wants to visit a website hosted by another ISP. One can ask, for instance, whether the former ISP should charge the latter one or vice versa, given that both the consumer and the web-site benefit from the visit.

Chapter 3 provides a background of the regulatory and legal framework that applies to the member states of the European Union. Section 3.1 starts with a historical overview. Section 3.2 discusses policy objectives. Section 3.3 zooms in at specific elements in the regulatory framework that are relevant for interconnection and call termination access. It contains an extensive discussion of interconnection and the designation of operators with significant market power (SMP; 3.3.1), both under the old (3.3.2) and new regulatory framework (3.3.3). It also discusses potential remedies (3.3.4) and procedural provisions related to the imposition of ex ante obligations on operators designated with SMP (3.3.5). Section 3.4 concludes.

Chapter 4 summarizes and discusses the recent policy debate on mobile call termination. In particular, it addresses the question whether mobile operators have market power with respect to termination access – the question whether exercising market power is bad for welfare or consumers will be treated in subsequent chapters. It is organized as follows. Section 4.1 introduces the antitrust notion of defining the relevant market, which is the usual starting point for policy makers. Using the recent policy discussion in the United Kingdom (UK) as a general example, section 4.2 applies the concept of market definition to mobile call termination and discusses whether mobile operators have market power. Section 4.3 describes similar debates that have taken place in the Netherlands and in Australia. Section 4.4 concludes the chapter by pointing out that the exercise of market definition, which naturally leads to the conclusion that call termination on individual networks are relevant markets on which mobile operators have 100% market share, should – from a welfare viewpoint – not automatically lead to the conclusion that termination charges should be regulated. Why this is the case, is discussed in the subsequent chapters.

Chapter 5 contains an economic analysis of fixed-to-mobile network interconnection based on economic models. Section 5.1 summarizes some central results from the literature on access in telecommunications markets and surveys the literature on call termination on mobile networks. Section 5.2 provides additional results from numerical simulations. The model is presented in subsection 5.2.1, while results are presented and

discussed in subsection 5.2.3. In the models discussed in sections 5.1 and 5.2, the issue of cost recovery was ignored. To address this issue, section 5.3 extensively deals with Ramsey pricing and the recovery of fixed and common costs. Section 5.4 concludes the chapter.

Using the insights of the previous chapters, in chapter 6 we focus on the welfare effects of call termination monopolies and discuss potential remedies. Ths chapter is organized as follows. Section 6.1 gives a general overview of potential welfare effects. Section 6.2 discusses structural remedies that are more or less straightforward: eliminating the asymmetry between the fixed and the mobile sector (subsection 6.2.1), changing from ‘calling party pays’ (CPP) to ‘receiving party pays’ (RPP; subsection 6.2.2), and implemeting the technical remedy of ‘call termination bypass’ (subsection 6.2.3). Section 6.3 revisits access prices regulation and cost recovery, which was the topic of section 5.3. Section 6.4 concludes the chapter.

Chapter 7 concludes the report. It contains a summary of the outline of the reasoning throughout the different chapters, and recapitulates the policy implications.

2. Overview of telecommunications

This chapter provides an introductory background to telecommunications markets. It summarizes relevant market developments and contains a basic and simplified description of the principles (and terminology) underlying the operation of telecommunications technologies – in particular fixed and mobile telecommunications – and types of access to networks.

The structure of this chapter is as follows. In order to provide some perspective, section 2.1 gives an overview of recent market developments. Section 2.2 gives a description of the technologies of fixed and mobile telecommunications. It introduces the reader to common terminology and provides basic explanations of network interconnection and access to networks. Also, ti contains a short overview of different access situations, namely one-way access and two-way access. Chapter 2 can be skipped by readers who are familiar with telecommunications technology and market developments.

2.1 Recent market developments[14]

In the past five years, the number of mobile users, as well as traffic volume from mobile phones, have demonstrated steady growth in western European and many other countries. For instance, the number of mobile subscribers in the EU increased from 69 million in 1998 to 306 million in 2003 (EC, 2003b). In particular during the late 1990s, new customers contributed to rapid growth of second-generation (2G) mobile markets (the GSM standard in Europe).

A substantial number of the new mobile users entered the market under prepaid arrangements in combination with handset subsidies. However, prepaid users contributed relatively little to the growth in the number of call minutes, compared to users with subscriptions. Reasons for this difference are, for instance, that prepaid users include people who want to control their budget more tightly (e.g. adolescents) and people who expect to use their phone relatively little (e.g. compared to corporate customers). Moreover, per-minute prices charged to prepaid users are typically higher than those charged to subscribers. Since the strategic focus of mobile operators gradually shifted away from attracting new users as the market matured, prepaid offerings have become less prominent in their marketing tactics.

In the last couple of years, the steep rise in penetration and revenues from usage of mobile phones has levelled off to a more modest growth level. For instance, the average penetration rate in the EU increased from 18% in 1998 to 70% in 2001, and 81% in 2003 (European Commission, 2003b). The average monthly expenditure for a typical personal user decreased with 23%, and for a typical business user with 20%, during the period 2000-2002 (European Commission, 2002b). Therefore, instead of selling phones and subscriptions to new users, mobile operators must now rely more and more on retention of existing customers and stimulating the use of mobile phones in new ways. In

[14] This section is partly based on CC (2003) and EC (2002b).

particular, operators have become less keen on offering rebates or subsidizing handsets to prepaid users, since these customers generate a lower 'average revenue per user' (ARPU). Operators' marketing efforts have been redirected to new tariff packages and services other than voice telephony, in particular data services. The short message service (SMS) has been a very successful one, for instance because of its popularity among schoolkids. More recent services include transmission of multimedia messages (including soundbites or images) and Internet-type services. An examples of the latter is a packet-switched technology (i.e., data is split into small packets that are separately transmitted, as is also the case for the Internet) known as GPRS.[15] An example of the latter is NTT DoCoMo's *i-mode*, marketed and sold in the Netherlands by KPN.

In several countries in Western Europe, governments set up auctions to award licences for the next generation (3G) of mobile telephony, known as UMTS. Several multinational operators paid very substantial amounts of money for 3G licences, especially in the United Kingdom, Germany, Italy, and the Netherlands.[16] After the dust of the auctions had settled, doubts started to rise about the future revenues to be obtained with 3G services. With hindsight, it seems that operators participating in the auctions, and also the banks that were financing the bids, were overly optimistic, perhaps blinded by the hype of the 'new economy'. As a result, several operators ended up being debt-ridden without having favorable prospects of recovering their licence fees with future revenues from 3G services.

The declining growth in mobile markets, the unprepossessing financial positions of several operators resulting from the 3G auctions, and the need for capital to roll out UMTS networks, have increased the pressure in the mobile industry to generate cash. Mobile operators try to make revenues across the whole range of services that they offer.

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[15] GPRS: General Packet Radio Service, also denoted by 2.5G, as it is an intermediate step between the current, second generation of mobile technology, and the third generation (UMTS in Europe). WAP, although circuit-switched instead of packet-switched, was meant to provide access to "sites" resembling bare-bones websites.

[16] See e.g. Van Damme (2002).

One of these services, termination access to mobile users, has come under close scrutiny recently from regulators and competition authorities alike.

2.2 Fixed and mobile networks[17]

Telecommunications networks permit transmission of information (e.g. voice or data communication) between terminal devices such as telephones. This is done by establishing a connection, through a network, between the devices of different parties. A network typically consists of:

- Transmission systems: the means by which information travels through the network. An important element is the transmission medium (e.g. wire or a wireless radio system).
- Switching systems (also called switches): the means by which temporary connections between subscribers are established.
- Signaling systems: the means by which information about connections (e.g. the phone number of the called party, and whether a call is toll-free or not) are conveyed.

Moreover, at a stylized level one can distinguish two types of transmission systems, which are complementary to each other:

- A customer access network (also known as local network), which connects end-users' devices to local switches. The transmission medium typically consists of wire (e.g. copper wire or optical fibre) or radio spectrum.
- A long-distance network (also known as backbone), which enables calls to be routed between local switches, possibly through switches at a higher level in the hierarchy of a network. The transmission medium usually consists of copper wire, cable, and optical fibre.

[17] This subsection is based on CC (2003, chapter 3) and De Bijl and Peitz (2002, chapter 2). It is restricted to the current, second generation of mobile telecommunications in Europe, which is known as the GSM standard. For a description of the mobile industry, see also Hausman (2002).

The most prominent difference between a fixed and mobile network is the nature of the transmission medium of the customer access network. A telephony network is called a fixed network if the connections to end-users, either wired or wireless, are fixed in location. Hence, users cannot move around with their devices, except in the range allowed by the wire between handset and socket, or, in the case of a wireless telephone, by the reach of the wireless connection (with a range typically in the order of magnitude of a house and its immediate surroundings).

Mobile telephony is characterized by the feature that telephones use radio connections allowing users to move around in a much larger range, in the order of magnitude of a country or parts thereof. The long-distance part of a mobile network, that is, all connections except those that establish links with end-users' mobile phones, is similar to a fixed network. In fact, mobile operators may use existing long-distance networks of fixed operators to transport calls. The links between radio signals transmitted by handsets and the long-distance network are formed by 'base stations', which can often be recognized by radio antennas on high buildings and towers. In order for a mobile phone to operate, it must be within the coverage of a base station.

The coverage pattern formed by several base stations typically resembles a honeycomb structure, which is why the coverage areas of base stations are known as cells and mobile telephony is also called cellular telephony. Coverage from neighboring cells usually overlaps: the call made by a subscriber traveling from one cell to another can be handed over to the new cell (a process known as 'handoff' between adjacent cells), while coverage is not lost inbetween cells.

The current generation of mobile technology in Europe is known as the GSM standard. A typical GSM network can be broken down into three 'layers':

- The radio layer, comprising base stations and base station controllers (BSCs). The base stations provide the radio coverage, while the BSCs

concentrate calls from various base station in order to pass them on to a switch. This layer can be viewed as the local access network.

- The mobile switching center layer, comprising mobile switching centers (MSCs) and databases that store information about the network's subscribers and current locations of phones. Each BSC is connected to one MSC.
- The transit layer, comprising transit switching centers (TSCs). These are switches that are connected with MSCs and carry calls between different TSCs. Each TSC is connected to neighboring TSCs; together they form the long-distance backbone of the network.

The databases in the switching center layer that are used for storage and management of subscriptions are the home location registers (HLRs). An operator's HLR stores information about its subscribers, such as customers' service profiles, information about locations, and activity status. Each subscriber is registered in the HLR of the operator to which he or she subscribes.

The transit layer is usually also connected to other networks ('interconnection'). Some mobile networks do not use a transit layer, but instead have interconnected MSCs and directly interconnect with other networks. Figure 2.1 illustrates interconnection of fixed and mobile networks.

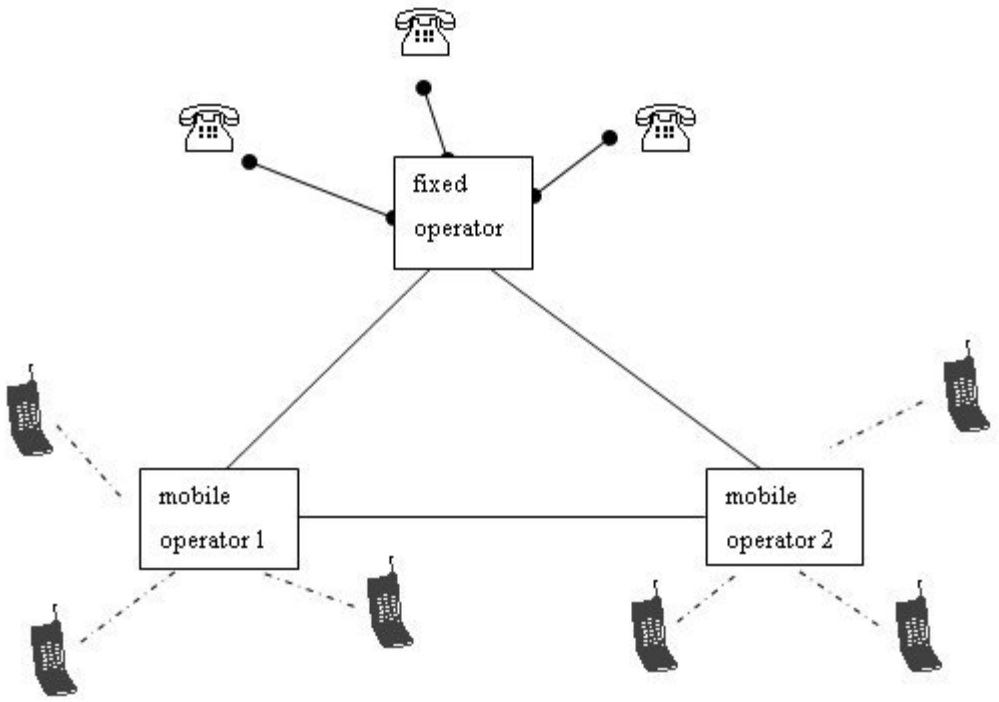

Figure 2.1: Network interconnection between fixed and mobile networks

From an operator's viewpoint, a crucial difference between a call to a fixed and a mobile subscriber is the need to locate the latter's phone. To know where (i.e., in which cell) a mobile phone is at each moment, the databases at the mobile switching center layer are automatically informed by a mobile phone (given that it is switched on and within radio coverage) of its present location. This process, known as location update, occurs when a phone is switched on or off, if it moves from one area (consisting of a certain number of neighboring cells) to another, and after a preset duration (typically about 30 minutes).

For a typical telephone call, a temporal connection is established that 'originates' from the calling party's phone and 'terminates' at the called party's phone. A particular feature of a liberalized telephony market is that the calling and called party do not always subscribe to the same network. From the viewpoint of a given network and its subscribers, one can therefore distinguish two kinds of phone calls:

- On-net calls, which originate and terminate on the same network, that is, calls between subscribers of the same network.
- Off-net calls, which terminate on another network, that is, calls to subscribers to another network than the one that the calling party subscribes to.

Note that one operator's off-net call is another operator's *incoming* call, which can be defined as a received call originating from another network's subscriber.

Off-net calls can occur between different fixed networks, different mobile networks, as well as fixed and mobile networks. A necessary condition is, however, that the networks are interconnected (i.e., connected to each other). Interconnection takes place at a 'point of interconnect' (POI). As already mentioned above, in a mobile network, the POI may be at a TSC on the transit layer, or, if it has no transit layer, directly at an MSC at the mobile switching center layer. Figure 2.2 illustrates the routing of a call from a fixed to a mobile user.

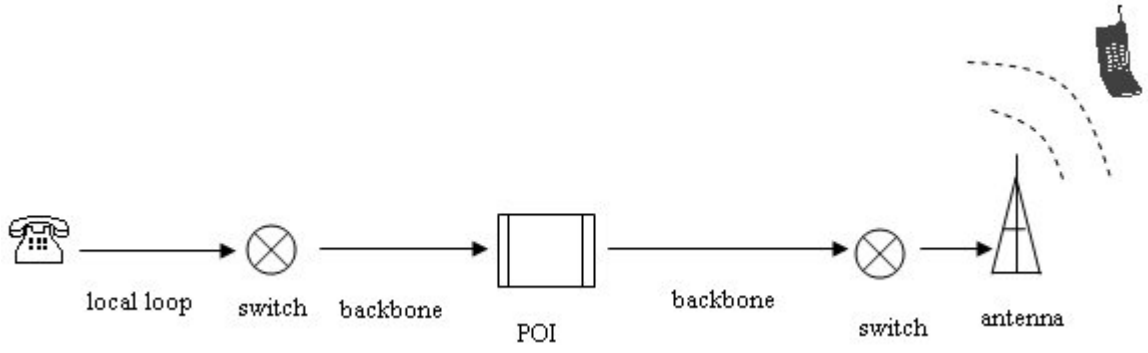

Figure 2.2: A fixed-to-mobile call

In the past, fixed subscribers often rented their handsets from the incumbent. When the equipment market was liberalized, consumers could, as an alternative, purchase a handset

in the market (in general, former incumbents cancelled the possibility for equipment rental shortly after that). A fixed handset can be plugged into any telephony socket, and hence be used in combination with a subscription to any fixed operator. A user of a fixed connection usually subscribes to the operator that owns the connection to that user. Alternatively, in the case of local loop unbundling, local switches are programmed to 'know' to which operator the user of a certain connection subscribes to. In both cases, subscriptions are independent of the handset.

In mobile markets, subscriptions often depend on the handset. Mobile phones are either offered in a bundle with a subscription contract or sold separately. In the former case, the handset may be subsidized, sometimes to the extent that it is given away for free, by revenues from subscriptions and call minutes. In both cases, a small card with a chip on it, the 'SIM' (subscriber identity module) card, has to be slotted into the back of the phone, providing it with the information about the network to which it should connect to. It also contains information about the subscriber, such as personal phone numbers and text messages. Note that it is the SIM card that contains subscriber information, not the phone. The mobile operator that issues a SIM card remains the formal owner for an indefinite period of time, according to the typical contract between an operator and a mobile user.

To make sure that a mobile handset subsidy can be recovered, a mobile phone can be 'locked' for a certain period of time, in the sense that it cannot be used to subscribe to other operators. This can be done by programming the phone such that it only works with a specific operator's SIM card. Without such a 'SIM-lock', a mobile user can slot any SIM card into his or her phone, and hence connect to any operator. In order to obtain a SIM card, however, the user must purchase either a subscription or a prepaid contract from an operator.[18]

[18] Alternatively, mobile phones may be permanently locked, without a separate card or card slot. This situation occurs in the US.

The product and services bundle that a mobile user typically purchases consists of a mobile phone in combination with a SIM card corresponding to a unique telephone number, the ability to make calls, the ability to receive calls, and various other services, (e.g. voicemail, international roaming, the ability to send and receive short message services (SMS) or more advanced multimedia services). Mobile network technology is such that by default, only the operator to which a consumer subscribes can deliver calls to that consumer. Hence, call delivery is necessarily a part of the bundle offered to end-users. Given the current state of technology, which implies that a mobile phone can only be attached to one network at a time, and changing to another network takes considerable time, 'call termination bypass' is not a realistic option. In chapter 6 we will further discuss the prospects of introducing competition in call termination by technical means.

We conclude this section by introducing some notions that surface elsewhere in this report. In a *one-way access* situation, only the incumbent firm has a network with access to end-users. Hence the incumbent has a monopoly over an essential input – access to consumers via its network – needed by entrants, while the incumbent itself needs no inputs from its rivals. Accordingly, access to end-users is often viewed as a bottleneck or essential facility, especially if there are sunk costs involved and the network element cannot be duplicated in an economically viable way. In order to offer telephony services, entrants without local-access networks must purchase access to end-users from the incumbent. Typically, the incumbent operator is vertically integrated: it offers wholesale access to entrants and also competes with them in the retail market for telephony services. Entrants operate only in the retail market. In practice, it may be the case that an entrant has a long-distance network at its disposal, but no connections to end-users (the 'local loop' or 'local access network').

Note that in a situation of one-way access, entrants need to buy both originating and termination access on the wholesale market to be able to offer telephony services. This terminology is derived from the notion that for a typical telephone call, say from

subscriber *A* to subscriber *B*, a connection is established that originates from the network that *A* subscribes to, and terminates at the network that *B* subscribes to.[19]

In a situation of *two-way access* there are several operators, each one with its own network, who need one another to terminate calls between their networks. The feature that distinguishes such a situation from one-way access is reciprocity. Since subscribers of one operator may want to call subscribers of another one, all operators need access to each others' subscribers, and hence termination access to each others' networks. This situation may correspond not only to a mature market, in which entrants have their own local networks, but also to an infant market, in which entrants are still building up market share and rolling out their networks.

[19] The economics literature on one-way access typically simplifies this picture, in most cases without loss of generality, by viewing access as a joint service that consists of both originating and terminating access.

3. The legal framework in Europe

Interconnection (see the previous chapter for explanations of this and other terminology) is one of the vital elements for a competitive telecommunications sector. Interconnection ensures interoperability of networks. Its primary objective is to enable any subscriber of one network to communicate with any subscriber of another. For this purpose, an operator whose subscriber initiates a call to a subscriber of another network should be able to terminate the call on this other network. In other words, the operator from which the call originates should have access to the network of the other operator to terminate the call. Interconnection is thus a special type of access. Telecom operators typically have a right and an obligation to interconnect, which they realise by entering into interconnection agreements which are subject to commercial negotiations. The cost of call termination is a decisive component of the interconnection rate charged by operators under the terms of the negotiated interconnection agreement.

The regulation of European telecommunications – or electronic communications, as they are not designated in regulatory terminology – markets takes place within a framework of harmonized rules agreed at European Union level. This framework is then implemented by the EU Member States. Problems of market failure and potential remedies have to be assessed within this framework. In addition, EC and national competition law remains applicable to issues arising in the telecommunications markets; as will be seen below, the regulatory framework is meant to be streamlined with competition law, in order to ensure a coherent and consistent policy approach.

This chapter provides a background of the regulatory and legal framework that applies to the member states of the European Union. It is organized as follows. Section 3.1 starts with a historical overview. Section 3.2 discusses policy objectives. Section 3.3 zooms in at specific elements in the regulatory framework that are relevant for interconnection and call termination access. It contains an extensive discussion of interconnection and the designation of operators with significant market power (SMP; 3.3.1), both under the old

(3.3.2) and new regulatory framework (3.3.3). It also discusses potential remedies (3.3.4) and procedural provisions related to the imposition of ex ante obligations on operators designated with SMP (3.3.5). Section 3.4 concludes.

3.1 Historical overview

To achieve liberalization of the telecommunications market, a regulatory framework comprising a number of directives and related instruments came into place on 1 January 1998.[20] The key regulatory instruments that were used were control of retail prices, control of access prices, and universal service obligations. The framework set up by the directives was designed to manage the transition toward competition, and therefore included several regulatory asymmetries with respect to incumbents versus entrants. It was meant to be transitional and was subject to review after a relatively short term. The 1999 Review then proposed a new, simplified legislative framework that became applicable as of 25 July 2003.

The new framework can be seen as a response to the changing and 'converging' world of electronic communications, where data can be delivered over a variety of different, interconnected networks, including the Internet. It aims at ensuring harmonisation and

[20] The main directives are: (i) based on Article 95 EC: Directive 90/387 of 28 June 1990 (Open Network Provision (ONP) Framework Directive) [1990] OJ L 192/1 (as amended by Directive 97/51 of 6 October 1997 [1997] OJ L 295/23), Directive 92/44 of 5 June 1992 (ONP - Leased Lines) [1992] OJ L 165/27 (as amended by Directive 97/51 of 6 October 1997 [1997] OJ L 295/23), Directive 97/33 of 30 June 1997 (ONP - Interconnection) [1997] OJ L 199/32 (as amended by Directive 98/61 of 24 September 1998 [1998] OJ L 268/37), Directive 98/10 of 26 February 1998 (ONP - Voice Telephony) [1998] OJ L 101/24, Directive 97/13 of 10 April 1997 on a common framework for general authorizations and individual licenses in the field of telecommunications services [1997] OJ L 117/15 and Directive 97/66 of 15 December 1997 concerning the processing of personal data and the protection of privacy in the telecommunications sector [1998] OJ L 24/1 and (ii) based on Article 86 EC: Directive 90/388 of 28 June 1990 on competition in the markets for telecommunications services [1990] OJ L 192/10 (as amended by Directives 94/46 of 13 October 1994 [1994] OJ L 268/15, 95/51 of 18 October 1995 [1995] OJ L 256/49, 96/2 of 16 January 1996 [1996] OJ L 20/59, 96/19 of 13 March 1996 [1996] OJ L 74/13 and 1999/64 of 23 June 1999 [1999] OJ L 175/39).

legal certainty accross the EU. This is, for instance, achieved by ensuring that the same markets are analyzed in all member states, and that market parties are informed of this in advance. Moreover, specific conditions necessary for regulatory intervention by NRAs have been specified (possibly justified by national circumstances).

The new regime also relies more on general competition rules and less on ex ante, sector-specific regulation. The envisaged end-state is one that is completely governed by competition law. The new framework is made up of a package of six "electronic communications" directives,[21] of which the Framework Directive and the Access Directive are most relevant for this study, and furthermore a Recommendation on relevant product and service markets,[22] and Guidelines on market analysis and the assessment of significant market power.[23] The central plank of the new framework is a revamped regime of heavier regulation for firms holding Significant Market Power (SMP).

[21] The new framework is made up of the following directives (i) based on Article 95 EC: Directive 2002/19 of 7 March 2002 (Access Directive) [2002] OJ L 108/7, Directive 2002/20 of 7 March 2002 (Authorization Directive) [2002] OJ L 108/21, Directive 2002/21 of 7 March 2002 (Framework Directive) [2002] OJ L 108/33, Directive 2002/22 of 7 March 2002 (Universal Service Directive) [2002] OJ L 108/51 and Directive 2002/58 of 12 July 2002 (Privacy Directive) [2002] OJ L 201/37 and (ii) based on Article 86 EC: Directive 2002/77 of 16 September 2002 on competition in the markets for electronic communications networks and services [2002] OJ L 249/21.

[22] Recommendation 2003/311 of 11 February 2003 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21 [2003] OJ L 114/45..

[23] Guidelines on Market Analysis and the Assessment of Significant Market Power under the Community Regulatory Framework for Electronic Communications Networks and Services [2002] OJ C165/6.

3.2 Policy objectives

From a legal perspective, it is useful not to forget that the starting point is freedom of contract and the commercial freedom of firms to conduct their business. Accordingly, since interconnection involves two firms deciding to provide access to each other's network, it would *prima facie* be a private matter for these two firms to discuss and agree among themselves. There needs to be a good justification for the law to interfere with these freedoms and impose constraints on whether firms may refuse to grant interconnection or on the conditions under which they do so.

In essence, the law concerning interconnection of telecommunications networks evidences two lines of justification for regulatory intervention:

- *public policy objectives* relating to the greater good, according to which the State can interfere with the freedom of private firms in interconnection matters in order to ensure the fulfillment of a public policy objective whose significance exceeds the private interests of the parties. This would typically be the case where, for instance, a failure to interconnect two networks would inflict significant losses on society and the economy, because users of the respective networks would find themselves unable to communicate across networks. State intervention in such cases occurs through sector-specific regulation;
- *economic regulation*, where the operation of market forces is unlikely to lead to an optimal result. For example, if one of the firms involved enjoys market power, it can either refuse to grant interconnection to smaller firms or – perhaps more likely – grant it on abusive terms. Here State intervention is not so much concerned with ensuring that interconnection is taking place, but rather with ensuring that interconnection is not used to influence adversely the functioning of the market. The State has a choice of means through which to intervene: this type of problem can be addressed via general competition law or sector-specific regulation.

Intervention on both grounds (public policy, economic regulation) is provided for in EC communications law. Historically, the first major piece of legislation dealing with interconnection was Directive 97/33,[24] found in the ONP framework as it was reformulated ahead of the full liberalization of the telecommunications sector in 1998. A number of soft-law instruments were adopted under the said Directive. This is known as the old framework.

Since 25 July 2003, a new EC regulatory framework for electronic communications replaced the old ONP set of directives. Together, the Framework and Access Directives set out a regulatory framework determining the rights and obligations of undertakings seeking interconnection and the powers of the national regulatory authorities to regulate interconnection issues. The Framework Directive specifies the following, general goals of regulatory intervention:

1. to promote competition in the provision of electronic communications networks, services and associated facilities and services (by, inter alia, ensuring that users derive maximum benefit in terms of choice, price and quality);
2. to contribute to the development of the internal market (by, inter alia, removing obstacles to the provision of networks and services, and by encouraging interoperability of pan-European services and end-to-end connectivity);
3. to promote the interests of the citizens of the EU (by, inter, alia ensuring that all citizens have access to a universal service).

The Access Directive contains a provision bridging the gap between the old and the new framework. As stipulated in Article 7 (1) of the Access Directive, the obligations with regard to interconnection which were imposed on the telecom operators pursuant to the ONP Interconnection Directive are to remain in force until national regulatory authorities (NRAs) will have conducted the market analysis in accordance with the new framework

[24] Supra, note 20.

to determine whether to maintain, amend, or withdraw the obligations.[25] Since the new framework has not yet been fully implemented and applied (especially as regards the new SMP procedure, discussed below) by all the Member States, references to both old and new legislation will be made with a special emphasis on changes which were brought about by the new framework into the interconnection regime.

[25] Access Directive, Article 7.

3.3 Specific elements of the EC regulatory framework as it applies to MTA

3.3.1 The general obligation to interconnect

The Access Directive defines interconnection as 'the physical and logical linking of public communications networks used by the same or a different undertaking in order to allow the users of one undertaking to communicate with users of the same or another undertaking, or to access services provided by another undertaking.'[26] Thus, apart from regulating interconnection of fixed and mobile telecommunications networks, the Directive is equally applicable to interconnection of other electronic communications networks such as cable television networks, satellite and Internet networks, etc.

The Access Directive provides for the differentiated regulation of interconnection depending on the market position of the operators. While there are some general obligations which are applicable to any operator, the Directive establishes a system according to which a number of specific ex ante obligations can be imposed on operators with significant market power (SMP). As will be seen below, in contrast to the old framework, the designation of an operator as an operator with SMP has to be made following a market analysis, and the imposition of specific obligations is no longer automatic. In this respect, the new framework brings sector-specific regulation very much in line with competition law (which is also based on economic analysis).

The part of the regulatory framework on the general obligation to interconnect reflects the first justification for intervening in interconnection matters set out above (relating to public policy). One of the main objectives of the regulatory framework for electronic communications is to ensure end-to-end connectivity,[27] which is achieved, inter alia, by means of interconnection.

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[26] Ibid., Article 2.

[27] Framework Directive, Article 8 (3b).

There are different types of interconnection, depending on the type of interconnected operators: fixed-to-fixed, fixed-to-mobile, mobile-to-mobile, interconnection of leased lines, etc. Depending on how networks are linked, interconnection can be direct, i.e., if the network of operator A is linked at the point of interconnection directly to the network of operator B, or indirect, if the networks of operators A and B are linked via a third operator's network. The Access Directive establishes a single regulatory regime for all types of interconnection.

The Access Directive formulates a general obligation addressed to all operators of public communications networks to interconnect. What is implied in this interconnection obligation is the commitment to negotiate interconnection. In most cases, it will be an interconnection agreement between operators.[28] Article 3 of the Access Directives requires that the Member States do not hinder the interconnection negotiations between operators.

As is clear from the Preamble to the Access Directive,[29] what is important is the ability of customers of different networks to reach each other and to communicate, and interoperability in general, and not the way in which they are achieved. Thus, the obligation to interconnect extends to direct and indirect interconnection. However, in the case of indirect interconnection, the actual bilateral interconnection agreement between the operators may be absent.[30] Therefore, the obligation to interconnect in this context would probably mean a mutually agreed arrangement to use a certain third party for the purposes of establishing interconnection. For example, in the Netherlands, indirect

[28] Access Directive, Article 4 (1).

[29] Access Directive, Recital 8, .

[30] For the Dutch example of this situation, see The Regulation of Mobile Terminating Tariffs, Consultation document, OPTA, 19 December 2001, OPTA/IBT/2001/203784, Appendix I, text at footnote 28, p. 33.

interconnection of mobile operators (via the transit fixed line network of KPN) is the rule rather than the exception.[31]

The compliance with the general obligation to interconnect is reinforced by the powers of NRAs in the field of ex ante regulation and dispute resolution. First of all, the NRAs may impose an ex ante obligation to interconnect on those undertakings that control access to end-users (regardless of their market power).[32] For instance, the Dutch TA already contains an article to this effect.[33] Secondly, where commercial negotiations for conclusion of the interconnection agreement fail,[34] the NRAs have the competence to intervene in an interconnection dispute at the request of a party involved in the negotiation of the interconnection agreement and to issue a binding decision.[35] Presumably, by such a binding, decision an interconnection agreement may be imposed on one of the parties. For example, the Dutch TA states that if parties are unable to reach an agreement on interconnection, OPTA may be requested by one of the parties to lay down rules which will be applicable to both/all parties involved.[36]

3.3.2 The SMP regime

The part of the regulatory framework on SMP (significant market power) designation, which is the 'labeling' of operators so that they can be subject to specific ex ante obligations, concerns the second rationale for intervention set out above (economic regulation). The new framework is built on the presumption that the *ex ante* regulation of specific electronic communications markets is only warranted if markets are not

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[31] Ibid., Appendix I, text at footnote 28, p. 32.

[32] Access Directive, Article 5(1a).

[33] Article 6.1 (1), TA.

[34] Access Directive, Recital 6.

[35] Framework Directive, Article 20.

[36] Section 1, Article 6.3, TA.

competitive and, as a corollary to that, where there is at least one firm with SMP. The aim of obligations imposed on operators enjoying SMP is to compensate through regulatory measures the lack of competitive pressure and market forces that should normally ensure the development of a competitive market.

SMP under the old ONP framework

At the outset, it is useful briefly to set out the SMP regime of the old ONP framework. It helps to understand better the changes brought about with the new electronic communications framework. At the same time, the obligations imposed under the old ONP framework are still in force in many Member States where the NRA has not completed its first market definition and analysis exercise under the new framework.[37]

The SMP regime under the old framework provided that NRAs were to impose specific obligations on operators which were found to enjoy SMP on certain markets. For each of these markets, the applicable directives provided which obligation was to be imposed on SMP operators.

The Interconnection Directive is the most relevant for the purposes of this paper. The particular markets (or rather market areas) which it had in view for the purposes of an SMP designation were 1) fixed public telephone networks and services; 2) mobile public telephone networks and services; 3) leased lines services, and 4) interconnection.[38]

The old framework did therefore contain references to "markets", but those were not relevant markets in a competition law sense. For example, "interconnection" was one of the "markets" which could be regulated under the old ONP framework; under the new electronic communications framework, with a market definition exercise inspired by

[37] Access Directive, Art. 7.

[38] Freund (2001, p. 4).

competition law, this "interconnection" market has been broken down into a number of separate smaller relevant markets.[39]

Furthermore, under the old framework, significant market power was presumed if an operator's market share was above 25% of the particular telecom "market". NRAs could deviate from the strict compliance with the 25% threshold.[40]

As the list above made clear, the old ONP framework distinguished between fixed and mobile markets. The only obligations which could be imposed on mobile communications operators were:

- if they were found to enjoy SMP for "mobile public telephone networks/services", an obligation to grant special network access to other operators as well as transparency and non-discrimination requirements;[41]
- if they were found to enjoy SMP for "interconnection", an obligation of transparency and cost-orientation regarding interconnection charges.[42] Because of the way in which SMP on this "national market for interconnection" was to be assessed,[43] few mobile operators were subjected to this obligation.[44]

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[39] See the Access Directive, Annex I, for an indication of how the markets of the old ONP framework were going to be broken down.

[40] ONP Interconnection Directive , Article 4 (3).

[41] Ibid., Article 4(2) and 6.

[42] Ibid., Article 7(2).

[43] See Commission document "Determination of Organisations with Significant Market Power (SMP) for implementation of the ONP Directives" (1 March 1999).

[44] See the list of designated SMP operators under the old framework, available at http://europa.eu.int/information_society/topics/ecomm/all_about/implementation_enforcement/index_en.htm. See also Eighth Report from the Commission on the Implementation of the Telecommunications Regulatory package, European telecoms regulation and markets 2002, 03.12.2002, COM (2002) 695 final; Freund and Ruhle (2002).

Accordingly, as will appear from the case studies in Chapter 4, NRAs who wanted to intervene against high mobile termination rates under the old ONP framework had limited means at their disposal. Some used competition law powers (Oftel in the UK), others used their power to settle interconnection disputes under the general interconnection regime mentioned above (OPTA in the Netherlands), others yet introduced specific national interpretations of the old ONP framework which they had to defend before national courts (PTS in Sweden).

SMP under the new electronic communications framework

Under the new framework, the NRAs have to conduct a market analysis before any specific ex ante obligation can be imposed on the operators. Note that the new framework does not at the outset differentiate between the types of operators, whether fixed or mobile, that is, all operators can be subject to the same sort of regulatory obligations. If a particular electronic communications market is not effectively competitive, NRAs must identify an operator with SMP. Both the market analyses and the designation of an operator as an operator with SMP is carried out by the NRAs in accordance with soft law instruments,[45] the Commission Recommendation on relevant product and service markets,[46] and the Commission Guidelines on market analysis and the assessment of significant market power.[47] The Framework Directive expressly requires that NRAs take the utmost account of the Commission Recommendation and the Guidelines when defining and assessing relevant markets under the Directive.[48] The choice for the use of soft-law instruments instead of the legally binding acts[49] can be explained by reference to

[45] That is, 'instruments which have not been attributed legally binding force', Senden (2003), p. 104. See Article 249 EC on the lack of the binding force of recommendations.

[46] Recommendation 2003//311, *supra*, note 22.

[47] Supra, note 23.

[48] E.g., Framework Directive, Article 15 (3) and 16 (1).

[49] At earlier stages of the legislative process, the draft of the Framework Directive provided for the adoption of a Commission decision (which is legally binding) which would identify relevant product and services markets for the purposes of ex ante regulation.

such factors as the speed and flexibility in the adoption and amendments of the former as well as the fact that they are not susceptible to judicial review.[50]

The new framework continues to use the concept of SMP, but, it is now aligned with the general concept of economic dominance,[51] developed in the context of EC competition law.[52] An undertaking is deemed to have SMP if 'either individually or jointly with others, it enjoys a position equivalent to dominance, that is ... a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers.'

With the alignment of SMP with dominance, the SMP regime, which is a central part of sector-specific regulation in the electronic communications sector, becomes a means of policing market power, in addition to the means found in general competition law, namely the prohibition on abuses of dominant position[53] as well as merger control.[54] Before exploring the new SMP regime in greater detail, it might be useful to briefly compare it with those two elements of competition law in the following table.

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[50] Article 230 EC.

[51] I.e., the concept of dominance developed in the context of Article 82 EC in the case law of the ECJ and the CFI. However, an undertaking designated as an SMP operator for the purposes of the imposition of sector-specific obligations would almost automatically also fall under the scope of Article 82 EC, which prohibits however not dominance as such but abuses of a dominant position. The assessment of SMP is based on the model forecasting how competition in the markets for electronic communications is likely to develop in the future. The appropriate ex-ante measures should then be selected to match the anticipated market failure.

[52] Framework Directive Article 14 (2).

[53] Article 82 EC, together with supporting secondary legislation, first and foremost Regulation 1/2003 on the implementation of the rules on competition laid down in Articles 81 and 82 EC [2003] OJ L 1/1.

[54] Regulation 139/2004 on the control of concentrations between undertakings [2004] Oj L 24/1, with supporting secondary legislation.

	Article 82 EC	**Merger control regulation**	**Sector-specific regulation**
market definition	relevant market definition: product and geographical		
market analysis	dominant position	significant impediment to effective competition, in particular dominance	significant market power (SMP)
triggering factor	abuse	merger	characteristics of market, leading to selection in Recommendation
remedies	prohibition decision		
	fines	divestiture	
	transparancy, non-discrimination, supply/access requirements, obligations relating to pricing and cost accounting		

Table 3.1: Comparison of different regimes.

The Framework Directive establishes the procedure for the SMP designation, which consists of a number of steps which are explained in greater detail below.[55]

First of all, NRAs should define the specific markets whose characteristics may be such as to warrant the imposition of regulatory obligations. Under general competition law, both the relevant product and geographical markets should be identified.[56] Here the Commission sets out the relevant product markets in a recommendation, which should be reviewed regularly reflecting the changing market conditions. The Directive itself

[55] Framework Directive, Article 15..

[56] See the Notice on the definition of the relevant market for the purposes of Community competition law [1997]OJ C 372/5.

contains in Annex I a list of relevant product and service markets to be included in the first recommendation.[57] The Commission is also empowered to adopt a decision by which it will define transnational markets. The Commission issued the first Recommendation on relevant product and service markets at the beginning of 2003.[58] The NRAs are to follow the Commission Recommendation. While NRAs are not precluded from defining product/service markets for the purposes of SMP designation that differ from those listed in the Recommendation, they can only adopt a measure affecting this market after they have submitted its draft to the Commission and the latter does not object.[59]

The Framework Directive states[60] that the relevant product and services markets are identified on the basis of EC competition law criteria. The general approach of the Commission to market definition in competition law matters is set out in a Notice on Relevant Market Definition from 1997.[61] The Commission restated it for the purposes of the new electronic communications framework in its Guidelines on Relevant Market Analysis and the Assessment of SMP of 2002.[62] It can be argued whether market definition under the new regulatory framework is truly the same type of exercise as market definition under competition law.[63] Even if it were, when the new framework

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[57] It appears that notwithstanding the title of Annex I to the Framework Directive, "List of markets to be included in the initial Commission recommendation on relevant product and service markets referred to in Article 15", it nevertheless lists not only separate markets but also so-called market areas consisting of smaller markets. This is rather confusing. See Recommendation 2003/311, *supra*, note 22, Recital 8..

[58] Ibid.

[59] See Framework Directive, Articles 7 (4) and 15(3).

[60] Article 15 (1), ibid.

[61] *Supra*, note 56.

[62] *Supra*, note 22.

[63] Market definition under competition law is always about ascertaining the competitive constraints on the firm(s) under examination, whereas under the new regulatory framework it appears to be more of a market segmentation exercise. See Larouche (2002, p. 137).

speaks of "market definition", in fact the exercise comprises an extra step in comparison with competition law, namely the selection – amongst the various relevant markets – of those markets "the characteristics of which may be such as to justify the imposition of regulatory obligations".[64] The criteria for the selection amongst relevant markets were set out in Recommendation 2003/311, the first recommendation issued pursuant to the Framework Directive. These are, firstly, the presence of barriers to entry and development of competition of a legal, structural or regulatory nature, secondly, the dynamic aspects of the market structure, that is, the evidence that the market does not tend to become effectively competitive, and thirdly, the insufficiency of competition law remedies in the absence of ex ante regulation.[65]

As mentioned before, under the new framework, instead of defining a vague and broad "interconnection" market (as was the case under the old ONP framework), the Commission Recommendation identifies much smaller separate markets which can be subject to regulation, namely, in the case of mobile communications, access and call origination on public mobile telephone networks and voice call termination on individual mobile networks.[66]

NRAs have to undertake a further analysis to identify the geographical dimension of the relevant product/service market.

Once the relevant product and geographical market is established, the NRAs should assess the competition in this market. If following the market analyses in accordance with the Commission Guidelines, the NRAs come to the conclusion that the market is effectively competitive, they should refrain from the imposition of any specific

[64] Framework Directive, Art. 15.

[65] See Recommendation 2003/311, *supra*, note 22, Recitals 9-16

[66] Recommendation 2003/311, *supra*, note 22, paras. 15 and 16 of the Annex.

obligations on the undertakings in that relevant market or withdraw the obligations previously enforced.[67]

If, following the market analyses, NRAs find out that a market is not competitive, they should proceed to identify an undertaking which individually (or jointly with others) is dominant in this market. In particular, in assessing whether an undertaking is dominant, not only its market share on the relevant markets is considered decisive but other factors such as countervailing buying power, technological developments, absence of the potential competition, etc., are taken into account.[68] With regard to the assessment of the market share of the undertaking in the interconnection market, the Guidelines suggest using the revenues generated for terminating calls to customers on fixed or mobile networks as an appropriate yardstick to measure the market share.[69]

In its Recommendation, the Commission identified "voice call termination on individual mobile networks" as a relevant market which came into consideration for sector-specific regulation. It might be useful to set out the main reasons put forward by the Commission to reach that conclusion:[70]

> "At a retail level a call to a given user or user's terminal is not a substitute for a call to another user and this limitation on demand substitution follows through at the wholesale level. In addition there is a legal obligation at the wholesale level to supply any to any interconnection so operators are legally obliged to conclude interconnect agreements. In respect of supply substitution, if the supplier of call termination raises its price, it is not easy for alternative suppliers to switch to supply that market because they

[67] Framework Directive, Article 16 (3).

[68] Guidelines on SMP, *supra,* note 23, para 78.

[69] Ibid., para 77.

[70] See the Explanatory memorandum to Recommendation 2003/311, *supra*, at pp. 32-34, available at http://europa.eu.int/information_society/topics/ecomm/useful_information/library/recomm_guidelines/index_en.htm.

would need the SIM card details of that user to do so. However, the market is wider than call termination on a given user terminal because it is not possible for an operator to readily price discriminate between termination charges to different users across their network. Therefore the relevant market is at least as wide as termination for each operator.

However, with such a starting point in market definition, the supplier and the product are perfectly linked. It is important therefore to consider the possibilities for demand and supply substitution that might constrain termination charges and also the behaviour of network operators in setting termination charges.
[The Commission finds that there are no realistic possibilities for substitution at either the wholesale or retail level].

Another possible constraint on the ability of operators to set excessive termination charges may come from buyer power at the retail level.
[The Commission finds that there is no evidence to support this hypothesis.]

In general therefore, whilst it is apparent that end-users who subscribe to mobile services have a choice about the network to which they subscribe and that it is relatively easy to switch between networks, there is limited evidence of widespread constraints on the pricing of wholesale call termination. The first option for market the scope of the market definition is one for call termination on each mobile network. This would imply that currently each mobile network operator is a single supplier on each market. However, whether every operator then has market power still depends on whether there is any countervailing buyer power, which would render any non-transitory price increase unprofitable.

Another option for the scope of the market definition would be a national market for (mobile) call termination but the supply side substitution necessary for such a definition does not currently exist.

A third option for the scope of the market definition would consist of linked national markets for mobile services. For this definition to be valid, mobile subscribers must be concerned about the price of calling mobiles and therefore termination charges (as an important determinant of such charges). It is also necessary that the services are strong complements so that subscribers do not consider the prices of the services separately when choosing a network but rather the price of the overall bundle or package. This would mean that a mobile operator could only raise termination charges and thereby the retail price of incoming calls, (without losing subscribers) if at the same time it reduced prices for other services in the bundle. In this case the assessment of market power in call termination would be similar to that for other services in the bundle. If call termination were less important, there might be scope for a higher degree of market power in call termination.

The conclusion at the current time (under a calling part[y] pays system) is that call termination on individual networks is the appropriate relevant market. However, such a definition would be undermined by (i) technical possibilities to terminate via other networks (this would broaden the market definition to call termination on all networks) (ii) evidence that users employ alternative means to circumvent high termination charges or (iii) evidence that users subscribe to networks on the basis of what it costs to be called (the last two would imply a linked market definition, comprising access, call origination and termination).”

For the purposes of the present survey, it should be emphasised that the narrow definition of "voice call termination on individual mobile networks"[71] as a relevant market implies that each mobile operator is very likely to be a monopolist on its own termination market and therefore each mobile operator has a great potential of being designated an SMP operator for the purposes of ex ante obligations.[72]

Possible remedies

When the NRA has identified an operator with SMP, it must decide which measure out of the whole range of possible obligations should be chosen to remedy a particular problem. For those operators who were designated operators with SMP under the old framework and whose SMP status was reaffirmed on the basis of the new framework, it might mean that their current obligations will continue to apply or will be altered, or that new obligations will be imposed.

These ex ante obligations need not be imposed in total. However, at least one obligation should be imposed on the SMP operator.[73] In selecting the remedy, the NRAs have to bear in mind the regulatory objectives outlined in the Framework Directive, such as fostering competition in the electronic communications sector, development of the

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[71] For criticism of the narrow market definition, see Gual (2004) and Larouche (2002).

[72] This is in line with an unfortunate trend in competition law to allow the definition of "access markets", where the relevant market essentially consists of a physical facility or intellectual property to which competitors of a given firm would like to obtain access. As the CFI judgment of 15 September 1998 in Case T-374/94, *European Night Services* [1998] ECR II-3141, shows, the risk of error is greater in such cases than in "classical" cases where market definition is conducted on the basis of market data. In addition, the holder of the facility or intellectual property will invariably hold a dominant position of that market, thereby shortcircuiting another element of the analysis. The Court of Justice endorsed the "access market" approach recently in Case C-418/01, Judgment of 29 April 2004, *IMS Health* (not yet reported).

[73] Guidelines on SMP, *supra*, note 23, para 114, and Larouche (2002).

internal market and promotion of the interests of European citizens.[74] Furthermore, they have to be guided by the principles of appropriateness and proportionality.[75]

The list of regulatory obligations includes the following obligations.

- *Transparency*[76]

  The scope of this remedy may include the requirement of making public specific information regarding accounting, technical specification, interconnection tariffs, etc. It may also encompass a duty to publish an (unbundled) reference interconnection offer (RIO) containing general terms and conditions for interconnection services. The SMP undertaking may be requested to modify the RIO in accordance with the instructions given by the NRAs. Annex II to the Access Directive enumerates minimum items which should in any case be covered by the RIO published by the operator who ensures unbundled access to the twisted metallic pair local loop. In other instances, NRAs possess significant freedom in employing transparency as one of the possible remedies. They are competent to define the precise scope of the transparency requirement, such as what information should be published, how full it should be, and how it should be published. For example, transparency may be used by the NRA in combination with other remedies to address the problem of high mobile termination charges. Making information available to consumers, e.g., on how much it costs to call a mobile phone user, may improve the consumer awareness. This will, in some instances, induce mobile subscribers to make a more informed choice in favour of a mobile network with lower termination rates. It may also encourage fixed network subscribers to change their calling pattern,[77] putting competitive pressure on the fixed-to-mobile charges.

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[74] Framework Directive, Article 8.

[75] Access Directive, Recital 15.

[76] Ibid., Article 9.

[77] Such as, keeping calls to mobile subscribers short or calling to request a call back.

- *Non-discrimination*[78]

  This is a requirement which demands, firstly, non-discrimination between various categories of operators who seek interconnection, that is, an operator under the non-discrimination obligation should interconnect applying equivalent conditions in equivalent circumstances to other undertakings providing equivalent services. Secondly, there should be no discrimination in treatment between the undertaking providing interconnection and its affiliates, on the one hand, and third operators, on the other hand, i.e., interconnection services should be supplied to third parties under the same conditions and of the same quality.

  Price discrimination is the most common form of discrimination. However, other forms of discrimination can manifest themselves through unfavourable conditions for interconnection (at a non-optimal level), delays, limited use of facilities, etc.

  It may be difficult to establish whether an operator breaches a non-discrimination obligation since interconnection agreements are concluded in the first place as a result of commercial negotiations. The agreements might reflect differentiation in treatment dictated by the specific needs of the parties. The compliance with the principle of non-discrimination should, therefore, be assessed on a case-by-case basis.[79] In practice, the non-discrimination obligation will often translate into a requirement that the firm set out a reference offer of which every party can avail itself.[80]

- *Accounting separation*[81]

  Under this obligation, an SMP operator should keep separate accounts of its interconnection services from other activities, so that its costs and revenues related to interconnection activities become transparent. Thus, accounting separation supports other remedies, such as transparency and non-discrimination. NRAs have a power to

[78] Access Directive, Article 10.

[79] Ng (1997).

[80] Access Directive, Art. 9(2).

[81] Ibid., Article 11.

access accounting records and data of the regulated companies which should be provided to them on request.

- *Obligation to give access to network facilities, including interconnection*[82]

  This obligation goes beyond the mere requirement that an undertaking should negotiate interconnection agreements if so the entitled party requires. The NRA may require that the undertaking with SMP should meet "reasonable requests for access … inter alia in situations where it considers that denial of access or unreasonable terms and conditions having similar effect would hinder emergence of a sustainable competitive market at the retail level, or would not be in the end-user's interest."[83] The NRA can accompany the obligation to interconnect by conditions covering fairness, reasonableness and timeliness. Under this heading, the NRA might, for example, impose strict time limits for negotiating interconnection an agreement or formulate certain conditions to be included in the agreement.

  It is also interesting to note that the Access Directive allows NRAs to factor in longer-term considerations, such as "the initial investment by the facility owner, bearing in mind the risks involved in making the investment" and "the need to safeguard competition in the long term."[84] This marks a departure from the old ONP framework, as well as from competition law, both of which tend to focus more on the short term (and thereby favour so-called "service competition" at the expense of "infrastructure competition").

- *Price control and cost accounting*[85]

  According to the Access Directive, price control and cost accounting as a remedy should be resorted to when a lack of competition makes it possible for an SMP

[82] Ibid., Article 12.

[83] Ibid.

[84] Ibid., Article 12(2)(c) and (d).

[85] Ibid., Article 13.

operator to maintain excessively high prices or apply a price squeeze, that is, further distort price competition to the detriment of end-users.

This remedy can be implemented by national regulators in a variety of ways as will be seen later in the comparative survey of the national approaches. Interconnection prices can be regulated by direct imposition of tariffs, or by using price caps, best practices (benchmarking), and other pricing methods on the basis of which SMP undertakings are required to adjust their charges.

Price control is supported by the requirement of cost orientation and cost accounting. Indeed cost orientation is the basic principle for pricing remedies, according to the Directive. Cost-oriented pricing must allow a reasonable return on the adequate capital employed. The Access Directive leaves the issue of choosing the method of cost recovery to the NRAs; here as well, it allows NRAs to take a longer-term view (favourable to "infrastructure competition"), since the remedy should be "appropriate to the circumstances taking into account of the need to promote efficiency and sustainable competition and maximise consumer benefits."[86]

NRAs can authorise a particular cost recovery system to be used by SMP undertakings and monitor compliance by means of an audit. The cost accounting methodology is not uniform. It may differ significantly from one Member State to an other since a wide spectrum of cost accounting systems has been developed for this purpose using differing cost bases (e.g., historic, current, forward-looking, best practices) and cost standards (e.g., FDC, LRAIC, LRIC, ECD).[87] Which cost accounting methodology is the most appropriate one for determining of termination rates remains a matter of controversy.[88]

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[86] Ibid.

[87] See Annex 2, Table 2, Eighth Report from the Commission on the Implementation of the Telecommunications Regulatory Packages, European telecoms regulation and markets 2002, 03.12. 2002

[88] Samarajiva, Melody & Srivastava (2000), p. 20.

- *Other obligations*[89]

  Regulatory obligations envisaged by the Access Directive are meant to operate as a exhaustive set.[90] In exceptional cases, however, ex ante obligations which are not explicitly listed in the Access Directive can be imposed by the NRAs but only after specific approval of the decision by the Commission.

The ex ante obligations are listed in the Access Directive in accordance with the weight of their regulatory burden on the undertakings. Thus, the regulation of interconnection charges seems to constitute one of the heaviest regulatory measures in particular where this remedy takes the form of the requirement that interconnection tariffs are cost-oriented.[91]

Overall, the Access Directive is not very explicit on the issue of what sort of obligation among those envisaged by it should be preferred to remedy a particular problem related to interconnection. NRAs of the different Member States may have divergent views on what remedy will be the most appropriate and proportionate in the national circumstances.[92] To ensure that this flexibility does not endanger uniformity in the application of the new regulatory framework across the Community, the European Regulators Group (regrouping all National Regulatory Authorities (NRAs) designated under the new framework) recently issued a Common Position on the approach to appropriate remedies in the new regulatory framework.[93] The ERG elaborated this document in close contact with the Commission and consulted interested parties.

In its Common Position, the ERG outlines which remedies appear suitable to deal with the various competition problems identified in the electronic communications, among

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[89] Access Directive, Article 8 (3).

[90] Ibid., Recital 4.

[91] Ibid., Recital 20.

[92] On the different national approaches (including overview of the conceptual differences) to regulation of interconnection, see Freund and Ruhle (2002).

[93] ERG (2004).

which excessive pricing in "termination markets".[94] The ERG is of the opinion that transparency or non-discrimination obligations cannot suffice to address the competition problems at play on termination markets, and concludes that only price control obligations (i.e. cost-orientation) will do. It then suggests to apply a price cap or a glide path on the way to cost-oriented termination tariffs, in order to mitigate the shock to the operators. It also indicates that new entrants might benefit from a limited "grace period".

Procedural provisions related to imposition of ex ante obligations on SMP operators

The NRAs are under an obligation to notify the Commission of the names of undertakings designated as undertaking with SMP and the specific obligations imposed on them.[95] This is to enable the Commission to ensure the proper application of Community law.[96]

According to the Framework Directive, decisions of NRAs concerning SMP designation and imposition of ex ante remedies are subject to an effective review of the merits (appeal) by the independent body which may or may not be a judicial instance.[97] The decision of a non-judicial body should always contain written reasons and be subject to further review by a court or tribunal which has a right to refer preliminary questions for the interpretation of EC law to the ECJ under Article 234 EC. Member States are required to ensure that the body entrusted with review functions should have the appropriate expertise to perform an effective review.

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[94] Ibid. at pp. 114 ff. The ERG Common Position places "termination" on the same footing as the main heads of competition problems, i.e. "vertical leveraging", "horizontal leveraging" and "single market dominance".

[95] Access Directive, Article 16.

[96] Ibid., Rec. 25.

[97] Framework Directive, Article 4.

3.4 Concluding remarks

The above overview describes the preconditions for sector-specific regulatory intervention in the electronic communications markets, the arsenal of ex ante remedies which can be employed by NRAs to address interconnection problems, in particular, high tariffs for fixed to mobile interconnection, and the procedure of their imposition. Chapter 4 includes a survey of the experience and approaches of the Dutch, UK, and Australian telecom regulators in dealing with the contentious issues of fixed-to-mobile interconnection.

4. The relevant market and the central policy issue

In this chapter, we will fill in the framework that was described in chapter 3. This chapter summarizes and discusses the current policy debate on mobile call termination. In particular, it discusses the definition of the relevant market and addresses the question whether mobile operators have market power with respect to termination access – the question whether exercising market power can be seen as undesirable (from a welfare perspective) will be treated in subsequent chapters.

This chapter is organized as follows. Chapter 4 summarizes and discusses the recent policy debate on mobile call termination. In particular, it addresses the question whether mobile operators have market power with respect to termination access – the question whether exercising market power is bad for welfare or consumers will be treated in subsequent chapters. It is organized as follows. Section 4.1 introduces the antitrust notion of defining the relevant market, which is the usual starting point for policy makers. Using the recent policy discussion in the United Kingdom (UK) as a general example, section 4.2 applies the concept of market definition to mobile call termination and discusses whether mobile operators have market power. Section 4.3 describes similar debates that have taken place in the Netherlands and in Australia. Section 4.4 concludes the chapter by pointing out that the exercise of market definition should not automatically lead to the conclusion that termination charges should be regulated.

4.1 The concept of market definition

As we have seen, a central issue in policy debates is whether mobile operators have 'excessive' market power with respect to termination access. Since competition authorities (by definition) tend to focus on the presence of monopoly power, and typically do this by starting with a market-definition exercise, it is useful to provide some background on monopoly power and market definition.[98] Let us note already here, however, that market power in itself is not undesirable from a welfare-perspective, as it provides firms with incentives to invest and enter markets in the first place. Policy makers and authorities, unfortunately, are not very precise about the point where things start to go wrong. In the conclusion of this chapter, we will propose a theoretical benchmark to draw the line between desirable and excessive levels of market power.

From a logical viewpoint, market definition is the first step of antitrust analysis. Defining the relevant market is typically done by determining (i) the products that compete with each other; and (ii) the geographical scope of the market. Without defining the market, it is impossible to calculate rough indicators such as market shares and concentration indices.

The Commission Notice on the definition of relevant market for the purposes of Community competition law provides guidance as to how the European Commission

[98] It is sometimes said, in an informal way, that terminating access can be seen as a 'bottleneck'. For example, Armstrong (2002) coined the term 'competitive bottlenecks' in this context. This terminology is related to the 'essential facilities doctrine' in antitrust, which says that a dominant firm must provide mandatory access to an essential input to its downstream competitors at a non-discriminatory price (Bergman, 2001). Landgrebe (2002) argues that if there is a 'terminating monopoly' on mobile networks, this is (from a formal viewpoint) not due to bottleneck characteristics or large sunk costs, so that there is no basis to apply the essential-facilities doctrine.

applies market definition.[99] According to the Commission Notice, the objective of market definition is to identify the competitors of a particular firm that have the power to constrain that firm's behavior and prevent it from behaving independently of competitive pressure, or shorter, to identigy competitive constraints on a firm. The definition of the relevant market is performed in two dimensions: the product and the geographical dimension. In the Commission Notice, the relevant product market is formally defined as follows:

> "A relevant product market comprises all those products and/or services which are regarded as interchangeable or substitutable by the consumer, by reason of the product's characteristics, their prices and their intended use",

and the relevant geographical market is defined as:

> "The relevant geographical market comprises the area in which the undertakings concerned are involved in the supply and demand of products or services, in which the conditions of competition are sufficiently homogeneous and which can be distinguished from neighbouring areas because the conditions of competition are appreciably different in those areas."

The Commission Notice explicitly distinguishes two types of supply substitutability, namely by firms already in the market and by potential entrants. Thus firms are subject to three sources of constraints:

1. *Demand substitution.* Assessing this type of substitution entails the identification of the set of products that consumers view as substitutes. This can conceptually done by performing a 'hypothetical monopolist test', which tries to assess whether a hypothetical single supplier can increase its profits by a 'small but significant and non-transitory increase in price' (SSNIP) above the 'competitive' level, for

[99] EC, 1997; 97/C 372/03.

instance a price increase in the range of 5-10% sustained during one year. If such a price increase is believed to be unprofitable, then close substitutes are added in a repeated manner until raising the price becomes profitable. The geographic extent of the market is determined in a similar manner, by gradually broadening the geographic boundaries of the market.

2. *Supply substitution.* This type of substitution may occur if firms can switch production to the relevant products and sell them in the short run without incurring substantial costs of adjustment or time delay. The additional output may have a disciplinary effect on competition similar to the demand substitution effect.
3. *Potential competition.* Assessing this source of competitive constraint should initially not be taken into account when defining the relevant market. However, if the position of a firm gives rise to competition concerns, then potential competition as a disciplining force should be assessed subsequently.

Note that in itself, the exercise of market definition ion the basis of a SSNIP test alone does not say much about the presence of entry barriers and market power. Such issues are addressed by analyzing supply substitution and potential competition. Interestingly, according to Harbord and Von Graevenitz (2000) the SSNIP test is hardly carried out in practice by competition authorities. This is possibly due to the fact that market data are difficult to obtain. As an informal illustration of the SSNIP test mentioned in the description of the first constraint, consider an example from the Netherlands:

> "At the beginning of 2001, KPN Mobile lowered its mobile termination charges by almost 25%. But the other four mobile network operators did not respond by lowering their prices the same amount. The other operators held their mobile termination charges at their existing high levels. This might indicate that there was not significant switching from the four other mobile operators to KPN. [...] After three months KPN reversed their action, bringing their mobile termination charges back to their previous high level. This event may be interpreted as a reverse SSNIP – or 'hypothetical monopolist test'. The other four mobile operators were not forced to react to the sharp decline of KPN and were able to

> maintain their high mobile termination charges without any significant losses, suggesting that their termination charges were not in the same market."
> (Dutch submission as quoted in OECD, 2004, p. 141)

It is important to note that defining the market may be complex and may lead to confusion, as was already pointed out by Fisher (1979):

> "[...] answering it [the question of what is the relevant market] in a sensible way can be an aid to analysis. The fundamental question is that of the constraints on power. Focusing on the question of relevant market can often lead to losing sight of that fact."
> (Fisher, 1979, p. 16)

Fisher (1979, p. 13) defines monopoly power as "the ability to act in an unconstrained way". As a consequence, the relevant market has to include "those products and services and firms whose presence and actions can serve as a constraint on the policies of the alleged monopolist" (p. 13). Hence the essence of market definition is an assessment the forces that impose discipline on the alleged monopolist. According to Fisher, the constraints on the alleged monopolist can be of two types – note that he includes 'potential competition', the third constraint in the definition of the EC, under the heading of 'supply substitutability:

1. Demand substitutability: the ability or ease of customers of the alleged monopolist to switch to substitutes (given actually encountered prices).
2. Supply substitutability: the ability or ease of other firms (either inside or outside the market) to produce a good similar to the one sold by the alleged monopolist.

In practice some confusion can arise if the hypothetical monopolist test is not correctly applied (Harbord and Von Graevenitz, 2000). For instance, as Gual (2004) asks, when are two distinct goods considered to be sufficiently close substitutes? The cut-off level is, at least, subjective, and in many cases one has to depend on survey data rather than

quantitative data. Also, how should one deal with strong complementarities in demand? Although such complementarities should not automatically lead to a market definition at the level of bundles of goods, they should probably be taken into account. In general, a correct implementation of the SSNIP test must take into account any constraints on the alleged monopolist. One may expect, though, that competition authorities will do that and not fall into traps.[100]

In the next section we will discuss a prominent case of market definition related to mobile call termination. One should keep in mind, however, that the particularities of market definition should not distract policy makers from what it is all about: assessing whether there is a market failure that significantly distorts welfare. That is the topic of later chapters.

[100] However, this may be too optimistic. After all the SSNIP test was not meant to deal with markets with externalities – or maybe not even complementarities.

4.2 The assessment of monopoly power, with an illustration from the UK

Market parties, regulators and competition authorities typically agree that in the situation at hand, the relevant geographical market is the country in which mobile operators compete.[101] Operators need nationally issued licenses to build and operate mobile networks. These licenses, and hence also the networks, are limited to national boundaries, and operators that are internationally active target national markets separately. We note that in general, it may not be easy to define the geographical market, but that this case is rather clear-cut (see also the Notice on Relevant Market Definition[102]). Because of the uncontroversial nature of geographical market definition, this subsection focuses on the definition of the relevant product market.

Contrary to the geographical dimension, the definition of the relevant product market has given rise to a lot of discussion. The apparent controversy may partly[103] be caused by the fact that on the one hand, the reflex of competition authorities and regulators, when they observe prices that are substantially above marginal costs, is to raise the alarm and perhaps intervene just because of the observed mark-ups. On the other hand, given the characteristics of the market it may be the case that high mark-ups are a natural outcome of the process of competition, without harm to welfare. It may therefore happen that the authorities want to 'restore' prices close to cost levels, while others (market parties, economists) see such an intervention as a distortion of competition and possibly also welfare. One should therefore keep in mind that the outcome of the market definition and analysis exercise in itself may not provide sufficient conditions for regulatory intervention (that is, the presence of monopoly power in a certain, partial market need not be problematic). Hence, later we will complete the picture by adopting a welfare viewpoint.

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[101] See e.g. CC (2003, ch. 6, p. 97), NMa (2002), and Frontier Economics (2003).

[102] Notice on the definition of the relevant market for the purposes of Community competition law [1997] OJ C 372/5.

[103] Of course, the main cause is that firms dislike any intervention that may lead to lower profits.

Recall from chapter 3 that in its Recommendation on relevant product and service markets, the European Commission designated the wholesale market for call termination on individual mobile networks as a relevant market in which ex ante regulation may be justified, given the market characteristics.[104] This market definition has also been recommended by the Independent Regulators Group (IRG) in the process leading to the new regulatory framework of communications markets in the EU.[105] According to the IRG, mobile call termination markets in member states have very similar characteristics and competitive conditions (although they depend on current circumstances). Nevertheless the national regulatory authorities in the member states have to assess themselves whether they see a need to intervene.

Market parties that want to avoid regulatory intervention have an incentive to claim that the relevant market is broad, so that it includes many substitution possibilities for consumers. In the UK for instance, operators argued that there is an overall market for mobile services; according to O_2, Vodafone, Orange, and T-Mobile, call termination is just one element of a bundle of services.[106] In Australia, similar claims have been made.[107] In a similar spirit, Gual (2004) argues call termination is purchased as a part of a bundle of other mobile services, such as call origination and SMS.[108] However, this type

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[104] Commission Recommendation of 11/02/2003 On Relevant Product and Service Markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communication networks and services; C(2003)497.

[105] See IRG (2004).

[106] CC (2003, par. 2.76, p. 29).

[107] "Complementarities in production and demand mean it is inappropriate to define the relevant market as the wholesale market for either mobile termination services, or mobile originating services alone", Frontier Economics (2003, p. 10).

[108] As a consequence, it may be optimal for firms offering a system of services to charge high mark-ups for services with inelastic demand. Hence, the occurrence of such mark-ups for individual services does not automatically signal that there is substantial market power.

of reasoning may be problematic as it ignores that because of CPP, call termination is a wholesale service that is not part of any bundle of mobile services purchased by end-users. It is a fixed operator who purchases fixed-to-mobile call termination wholesale, and mobile operators who buy mobile-to-mobile call termination wholesale – not a mobile customer in the retail market. A consumer that makes a call to a mobile user just buys an off-net telephone call (the call termination service is a wholesale ingredient to make this type of call possible).[109] Therefore, even if one accepts that there is a single mobile market where operators compete fiercely by offering service bundles in the retail market, call termination is not an element of these bundles. Hence it may not be subject to the same intensity of competition as the bundles in the retail market.

Operators also tend to claim that there is a single, national market for the provision of all mobile services, which is highly competitive. BT argues, for instance, that mobile and fixed telephony constitute the relevant market.[110] In general, operators tend to claim that there is a single, national market for the provision of all mobile services. Overall, the claims that there is a large and competitive mobile market, so that there cannot be a problem with call termination, ignores the possibility that mobile operators may not face any constraints when they set wholesale prices for termination access.

In a case deferred to the Competition Commission (CC) in the UK, an extensive analysis based on empirical market research, apparently with sufficient depth and quality, on

[109] It should be mentioned that the services bundle purchased by end-users includes the possibility of receiving calls from fixed lines. A relevant issue, which will be discussed later, is how much mobile users care about this (i.e., how much mobile operators may be constrained in their pricing of termination by consideration of this call externality). Moreover, the externality argument is not necessarily one that laissez-faire supporters may wish to push too far, since it is a traditional argument for regulation.

[110] CC (2003, ch. 6, p. 98). [check if formulation is perhaps that fixed and mobile are in the same market?]

mobile termination access has taken place.[111] To structure the discussion, we will go through the arguments of the CC. Nevertheless, the structure of the discussion below is quite general and applies to any country with a CPP regime, that is, to all countries in the EU. The analysis and conclusion corresponds to the recommendation on relevant markets made by the EC (see chapter 3).

The box below contains a description of the policy process in the UK. It can be skipped by readers who are primarily interested in the economic argumentation by the CC.

Box: Survey of the policy process in the UK.

In the UK, the Office of Communications (Ofcom) recently replaced Oftel as the independent authority in charge of implementation of policy in telecommunications sector. The new European Framework was implemented in the UK by the Communications Act 2003,[112] which essentially replaced the Telecommunications Act 1984.[113] Under the new Framework and the Communications Act, certain conditions can be attached to (mobile) operators with regard to interconnection following the procedure of market analyses provided by the Access and the Framework Directives. Oftel was the first European NRA to address interconnection of mobile networks, under the old legislative framework. This proved a long and complex procedure. Its successor Ofcom revisited the issue under the new framework. The actions of Oftel and Ofcom will be reviewed in turn.

Under the old framework of the Telecommunications Act 1984,[114] Oftel was empowered to modify licencing conditions provided that the affected operators do not object. In case of

[111] The origin of the case was Oftel's *Review on charge control on calls to mobiles*, 26 September 2001.

[112] 2003, ch. 21. It is available at http://www.legislation.hmso.gov.uk/acts/acts2003/20030021.htm

[113] 1984, ch. 12.

[114] Sections 12 and 12A, Telecommunications Act 1984.

operators disagreeing with those modifications, Oftel had to refer the issues to the Competition Commission (CC) which issued a report.[115] If the latter found that modifications are justified in the public interest, Oftel could proceed with the modifications notwithstanding the operators'

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[115] Section 13, ibid.

[116] Oftel Review of the charge control on calls to mobiles, 26 September 2001.

[117] Ibid, Oftel Review ..., Chapter 2 and, in particular, para. 2.49, p. 12.

[118] 'In defining a separate market for termination on each network, Oftel is not classifying termination as a "bottleneck", where that term is interpreted as meaning that substitution possibilities do not, and never will, exist', para 4.17, Oftel Review.

[119] Ibid, Chapter 6.

[120] See Oftel Press Release, 12 December 2001.

[121] I.e., the date of the entry into force of the new EC framework abolishing the licensing procedure.

[122] T-Mobile (UK) Ltd and others v. Competition Commission and Director-General Telecommunications, High Court of Justice of England and Wales (Queen's Bench Division), [2003] EWHS 1555 (Admin), Case Nos. CO/1192/03, CO/1308/03, CO/1536/03, 27 June 2003.

[123]Article 9 (3), para. 1 speaks about powers of the NRAs to intervene ex officio to lay down specific conditions to be observed by parties to an interconnection agreement. Para. 2 list in a non-exhaustively way such specific conditions, including those 'designed to ensure effective competition, technical conditions, tariff...'.

[124] Case C-79/00 *Telefónica de Espana SA* [2001] ECR I-10075.

[125] Paras. 55-61, T-Mobile (UK) Ltd and others v. Competition Commission and Director-General Telecommunications, High Court of Justice of England and Wales (Queens Bench Division), [2003] EWHS 1555 (Admin), Case No: CO/1192/03, CO/1308/03, CO/1536/03, 27 June 2003.

[126] Ibid, paras.101 ff.

[127] http://forum.europa.eu.int/Public/irc/infso/ecctf/home, file number UK/2003/0040.

[128] Document SG-Greffe (2004) D/200489, available at http://forum.europa.eu.int/Public/irc/infso/ecctf/home, file number UK/2003/0040.

[129] Available at http://forum.europa.eu.int/Public/irc/infso/ecctf/home, under the file number UK/2003/0040, as well as at http://www.ofcom.org.uk.

[130] Ofcom argued that "the lack of evidence of excessive charging, combined with the modest effect any charges have on consumers as a whole, mean that it would be disproportionate to impose ex ante obligations on 3G voice call termination at this time." (at para 5.31).

objections. Oftel was formally not bound by the CC Report. Telecom operators could bring an appeal against Oftel's decision modifying their licences to the High Court.

Oftel tackled the problem of high mobile termination charges by using its powers to modify conditions of individual licences granted to mobile operators. The exercise of these powers was based directly on old Licening Directive 97/13 and the provisions of the Telecommunications Act 1984. It was not conditioned by prior designation of a telecom operator as an operator with SMP.

Prior to the current regulation of mobile termination charges, Oftel had already maintained price control based on charge caps (Retail Price Index (RPI) - 9%) on the wholesale mobile termination charges of two mobile operators, BTCellnet and Vodafone. In anticipation of the expiration of this price control regime, which was in place from 1999 to 2002, Oftel conducted a new review of the mobile termination charges which resulted in the conclusion that they were excessively above cost.[116] The cost of calls was assessed using LRIC as a standard. Oftel established that the 'calling party pays' convention adopted in the telecoms industry seemed to present one of the major obstacles for increasing competitive restraints on call termination charges[117] and that it was unlikely, mainly due to technological hurdles, that new competitive pressure would emerge. It is noteworthy that, even though Oftel defined mobile call termination on each mobile networks as a separate market, it did not see call termination in terms of a 'bottleneck'.[118] Having considered various solutions, Oftel advocated a price cap mechanism as the most appropriate remedy to address the lack of competition in the mobile call termination market.[119] Not surprisingly, it proposed modifications to the licences of all four largest mobile operators reflecting a price control mechanism over interconnection charges in the form of price caps RPI-12% annually until March 2006.[120] Following operators' opposition, Oftel made a reference to the Competition Commission that issued its report in December 2002. Oftel followed the recommendation of the CC, namely that call termination on an individual mobile operator's network represents a separate market in which it holds a monopoly, and modified the licence conditions for the mobile operators on 4 April 2003. Moreover, by its Continuation Notice, Oftel proposed to extend the price cap regulation of mobile termination charges to the period beyond 25 July 2003[121] until its completion of the market review required under the new European Framework. T-mobile, Vodafone, and Orange subsequently appealed against both the Competition Commission's recommendation and Oftel's licence modifications to the High Court. In brief, the claimants challenged the decisions of the CC and Oftel on a number of grounds. The most important of these were, firstly, that the price control of mobile termination charges of

mobile operators which had not previously been designated as operators with SMP was unlawful and, secondly, that the continuation of price regulation after the new European framework entered into force was contrary to the relevant EC Directives.

On 27 June 2003, the High Court handed down the judgement dismissing the appeal in its entirety.[122] In particular, the judge held that Oftel did not lack a general power to regulate mobile termination tariffs of telecom operators without significant market power. He specifically relied on Article 9 (3) of Interconnection Directive 97/33[123] and the ECJ's judgement in Telefónica de Espana[124] in support of his conclusion.[125] With regard to the legitimacy of the Oftel's Continuation Notice, the court considered that that Article 7(6) of the Access Directive would permitted Oftel to take urgent measures related to price regulation, bypassing the process of designating of an operator as a SMP operator.[126]

Under the new framework, Ofcom was one of the first NRAs to conduct the market definition and analysis exercise under the revised SMP procedure provided for in the new EC regulatory framework. Ofcom (then still Oftel) sent a Consultation Document on Wholesale Mobile Voice Call Termination to the Commission on 12 December 2003,[127] to which the Commission replied with comments on 5 February 2004.[128] In the light thereof, Ofcom proceeded to adopt a definitive Statement on 1 June 2004.[129] The Statement does not introduce many substantive changes, when compared to the previous situation as described under the previous heading. Ofcom identified six relevant markets, one for each mobile communications network. It then found that each operator enjoyed SMP on its respective relevant market, with negative economic consequences. Ofcom decided not to impose any remedies as regards termination on 3G networks.[130] The established 2G network operators (Vodafone, O_2, Orange and T-Mobile) were made subject to obligations regarding the provision of termination upon request, non-discrimination, notification of price changes and, most importantly, price control by way of an obligation to lower termination charges to a specified target level in 2005 and 2006.

Given that we are interested in call termination on mobile networks, and that mobile networks are interconnected with fixed networks, we will not only consider mobile subscribers, but fixed users as well in the discussion that follows. The distinction between

mobile and fixed users making calls to mobile users is important, as in practice, especially fixed users' prices for calls to mobiles happen to be inflated. Without the existence of a fixed segment of users making calls to mobile users, the policy problem would be less prominent (the economic theory discussed in chapter 5 provides intuition about this observation).

With regard to substitution possibilities on the demand-side, it should be noted that one has to consider both fixed and mobile users, since both types of users can make calls to mobile subscribers.[131] Two cases can be distinguished. At the wholesale level, an operator wishing to pass on a call to a particular operator cannot circumvent call termination at that operator's network, and therefore must purchase the termination service from that operator. Thus, an operator wishing to establish a connection with an off-net customer cannot rely on its own or a third operator's network to reach a mobile customer. At the retail level on the demand side, there do exist possibilities for substitution. Fixed subscribers may have alternative ways of reaching a mobile user, such as using their own mobile phone (if they have one) to initiate the call, sending a text message (SMS), trying to reach the user over a fixed line, and asking the mobile user to call back. Even though there is evidence that this type of substitution takes place (see also Crandall and Sidak, 2004), these options, however, are not complete substitutes (see also Valletti, 2003). A seeming contender for demand-side substitution is the option to use a mobile phone instead of a fixed line, to make a call to a mobile number.[132] This requires that the fixed subscriber subscribe to a mobile operator as well, however. While penetration levels of mobile telephony may have been inadequate in the past, one would

[131] Note that in practice, mobile termination charges may not distinguish between the origin of an incoming call (i.e., mobile operators do not price discriminate at the wholesale level, based on the identity of callers). Nevertheless, at the retail level, fixed callers may pay very different prices for calls to mobiles than mobile callers.

[132] Retail prices for mobile-to-mobile calls are sometimes significantly lower than those for fixed-to-mobile calls, depending on the type of mobile subscription.

expect that this option for substitution plays a significant role at present.[133] Nevertheless, a customer survey commissioned by CC (2003) suggests that this is not the case, even if callers are aware of the incurred cost of making a call to a mobile user.[134] Apparently there is a significant lack of price sensitivity among consumers paying for mobile and fixed telephone services. A possible explanation is that the ability to immediately reach someone is a prominent element in the demand for calling a mobile user (CC, 2003; par. 2.145, p. 44). Alternatively, for many consumers there may be no (significant) price difference between calling from a mobile phone or from a fixed line.

The alternative ways of reaching a mobile user apparently do not add much weight in constraining wholesale prices for termination access. Sending a text message will often be inferior to talking over the phone – instantly speaking and listening over a two-way connection. Also, mobile users often cannot be reached through fixed connections, since they may happen to be in an area where there are no fixed connections available (e.g. in a car or in a rural area). Therefore, fixed-to-fixed calls provide a substitute only if certain conditions are satisfied, for instance the condition that the calling party is willing to wait until the mobile user can be reached through a fixed line (Crandall and Sidak, 2004). Moreover, the calling party may be clueless about which fixed number to call.[135] Finally, callback requires the cooperation of the called party, which is not evident as it involves a additional, time-consuming effort (and a financial burden). Overall, these partial substitutes do not generate sufficient countervailing buyer power, according to CC (2003).

Related to substitution possibilities on the demand side is the fact that the CPP principle precludes mobile users from caring about the tariffs for termination access. Based on various surveys commissioned by CC, Oftel and mobile operators, CC (2003) reports that

[133] Recall from the introduction that the average penetration rate in Europe increased from 18% in 1998 to 81% in 2003.

[134] Appendix 6.2, Section 6.4 in CC (2003).

[135] Exceptions occur if the mobile user is, for instance, at home or at work, and in the proximity of a line of which the caller knows the number.

mobile users are hardly or not concerned about incoming call costs when they choose a network. They care most about the price they have to pay to make calls themselves and the quality of the network – they principally focus on the value for money that they get when purchasing a subscription. Furthermore, customers' awareness of the particular mobile network they are calling is limited, and is likely to reduce because of number portability. Their knowledge of the different tariffs (both actual and relative prices) for various types of calls, such as off-net calls to mobile users originating from fixed and mobile networks, is also limited. For example, a large majority of customers do not know what they pay for a call from a fixed to a mobile phone, while a minority has only an approximate idea of the cost. Also, if mobile operators pass on the revenues from call termination to their own customers through lower prices (which is realistic if they compete fiercely to attract subscribers), then mobile users have an incentive to choose the operator charging the highest access price. Thus, intense competition in the mobile retail market may actually push access tariffs upwards. Some mobile users, however, may dislike high access charges, such as large companies and families, whose employees or members may have 'repeat calling relationships'.[136] Empirical evidence, however, suggests that residential users are hardly concerned with the cost of incoming calls incurred by relatives, nor do many people join the same network as their friends and family. Large corporate customers typically negotiate a joint contract for all their employees with a mobile operator, so that a large part of the calls they make remain on-net. Overall, according to CC (2003), there is not enough price sensitivity to push access prices sufficiently downward. To a large extent this is due to the fact that competition on the mobile market does not constrain operators' access prices (chapter 5 discusses this issue in detail).

In response to high prices, fixed callers will typically shorten the length of their calls to mobile users, so that (depending on the price elasticity of demand) mobile operators may lose revenues from call termination on their networks. Crandall and Sidak (2004) suggest that the recognition of the potential fall in profits will moderate the pricing of access

[136] Also called 'closed user groups'.

prices, that is, a potential reduction in demand will prevent a firm from setting excessive prices. This is true only to the extent that a monopolist, in order to maximize profits, will set its price such that marginal costs equal marginal revenues, but not higher – a monopolist does not have incentives to set its price above the monopoly level. Thus, despite its underlying logic, this type of argument does not say anything about constraints on in the sense of preventing a firm from acting like a monopolist.

With regard to supply-side substitution possibilities, one has to assess whether other firms step in to offer the call termination service. To make this possible, there must be alternative means, in particular a connection over an alternative mobile network, by which a call to a mobile user can be terminated. This, in turn, requires the possibility for mobile users to have more than one subscription and switch between phones or (in case of a single phone) between SIM cards, or alternatively, use a 'multiple-SIM' card. However, even if a mobile user owning a single phone would subscribe to several operators, usually only one SIM card at a time can be slotted into a phone.[137] Hence, even assuming that there is no SIM locking (which would make switching between cards impossible), a mobile user can often only be reached through the operator whose SIM card happens to be in use. Even if mobile users happen to have a mobile phone which has space for two SIM cards (making switching between operators easier), they have little incentives to do so because of the CPP regime. Therefore, supply-side substitution requires the possibility of a mechanism that induces a mobile phone to switch networks automatically. Without incurring substantial costs or time delay, at present there exist no such technological solution that is both practical and commercially viable. Therefore, alternatives that make supply-side substitution possible are not likely to come into existence in the sufficiently near future. Note in addition that operators are probably not in a hurry to introduce services or technologies that would cannibalize the revenues from call termination. Overall, supply substitution seems unlikely at present, or at best very limited, while the development of technological solutions to achieve this type of

[137] Oftel (2001) suggests that multiple SIM cards are possible in Italy, Finland and Portugal.

substitution is uncertain (see also Valletti, 2003, Crandall and Sidak, 2004, and Newbery, 2004).[138]

Summarizing the discussion on the assessment of monopoly power, the CC concluded that there are insufficient substitution possibilities at present, such as (at the supply side) technological means of terminating calls other than to the network that a mobile user subscribes to, or (at the demand side) substitute services for calling a mobile user. In addition, incoming call costs have little priority for most mobile users. Quite to the contrary, if competition in the overall mobile market is intense, then mobile operators are induced to pass on the revenues from call termination to their own customers. This mechanism actually drives up access prices, since mobile users will de facto prefer operators charging high access price for incoming traffic. It is also important to point out that that fixed operators are usually regulated so that they do not have countervailing bargaining power with respect to the determination of access prices.[139] Accordingly, a sensible conclusion is that mobile operators do not face downward competitive pressure on termination access prices.

Consequently, according to the CC, termination of voice calls on each of the networks of O_2, Vodafone, Orange, and T-Mobile constitutes a separate market, and that on each of these wholesale markets, the respective operator has 100% market share. Note that this implies that each operator has a dominant position on its own network with respect to termination access. It should be noted that this conclusion does not seem to be specific for the UK, but is quite general (even though it may depend on country-specific characteristics). See the following section for other countries.

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[138] In section 6.2.3 we will discuss this issue in more detail; a technological solution may be closer than is suggested here.

[139] If fixed and mobile operators would have equal bargaining power, for instance because regulation were symmetric or fixed access price were not regulated, then mobile operators' tendency to exercise market power might be reduced, since fixed operators would have the power to retaliate (Wright 2002; Crandall and Sidak, 2003).

Recall from chapter 3 that the EU regulatory framework is based on an ex ante perspective, so that evidence of abuse (i.e., use of monopoly power) is not necessary. It is sufficient to motivate the risk of abuse. Nevertheless, let us give a brief, informal assessment of the likelihood of 'abuse': do mobile operators actually exercise market power stemming from their monopoly positions in the markets for call termination? We have seen that there are no mechanisms (in particular demand and supply-side substitution possibilities, including potential entry), that prevent mobile operators from setting termination access prices above underlying cost levels. Simple and intuitive economic models (see chapter 5) readily confirm that, at least in theory, mobile operators will set access prices at monopoly levels or even higher than that (with regard to the demand for fixed-to-mobile calls). Chapter 1 provided some estimates of mark-ups in access prices, which were quite high compared to marginal cost levels. Overall, it seems safe to assume that prices above the level in a competitive wholesale market for termination access are being sustained.[140]

The view that termination access and the application of CPP give rise to a monopoly seems to be widely accepted by economists (see e.g. Newbery, 2004), sometimes implicitly through modeling choices (see e.g. Armstrong, 2002, and Wright, 2002, which will be discussed later) and sometimes more explicitly (see e.g. Valletti, 2003). An exception is Hausman (2002), who argues that if a 'problem' (that requires a regulatory intervention) exists, it is due to ignorance on the part of fixed users about the prices charged for terminating calls to mobile networks (given that there is a CPP regime). Note, however, that the arguments above depend only to a small extent on customer ignorance, while they nevertheless point at the existence of monopoly power. It is therefore not clear why ignorance would be a necessary condition for the existence of a policy problem.[141]

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[140] In chapter 6, we will come back to what is (or can) be meant with the competitive level of prices.

[141] Unfortunately, Hausman does not dig into this issue any deeper. Furthermore, according to Hausman, customer ignorance may not to a serious problem because customers receive specified bills and many calls are repeat calls. Even if it was a problem, Hausman argues that a

The outcome of the market definition carried out by the Competition Commission in the UK seems to be based on thorough empirical investigations. Nevertheless, the outcome may be a snapshot, while the problem as it is currently perceived may vanish over time, especially in a market with rapid changes related to both technology (e.g. multiple SIM cards) as well as usage patterns (e.g. fixed-mobile substitution). One should keep in mind though, as will be discussed later, for a welfare analysis and a discussion of potential remedies, the actual definition of the market is not directly relevant.

Even though the relevant market may be defined somewhat differently in different countries and at different moments, a fact remains that the application of CPP introduces a distortion because of perverse incentives. Mobile operators who increase their termination charges do not increase their own costs, but those of other operators, of which some do not compete with them (fixed operators). At a more abstract level, one could also argue that ultimately, all market power is 'in the hands of' mobile users, since they are able to capture a larger surplus.[142]

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technological solution, in particular requiring the terminating mobile network to identify itself (and the associated price) to the calling party, is superior to access price regulation, since the latter would introduce distortions.

[142] This is the case if access mark-ups lead, for instance, to handset subsidies. Such a situation arises if, because of intense competition in the retail market, all rents from call termination are dissipated.

4.3 Illustrations from the Netherlands and Australia

In addition to the example of the UK that was presented in the box in the previous section, here we provide two additional country examples.

4.3.1 The Netherlands

The Netherlands implemented the old Telecommunications Framework with the Telecommunications Act of 1998 (TA) which has recently been amended to implement the new EC regime for electronic communications networks.[143] The Dutch NRA, the Onafhankelijke Post en Telecommunicatie Autoriteit (OPTA), is now carrying out the new SMP procedure for the first time; it is at the market definition stage for the moment. It is too early to tell how interconnection between fixed and mobile operators, including mobile termination tariffs, will be treated under the new framework in the Netherlands. Before the new electronic communications framework was implemented, however, OPTA tried to deal with mobile termination tariffs under the old framework, using its power to settle interconnection disputes; it will be recalled that this dispute settlement power arises not from the SMP regime (second public policy rationale outlined at the outset of this chapter), but rather from the general regime concerning interconnection (first policy rationale). At the same time, under the Telecommunications Act of 1998, this dispute settlement power was to be exercised in the light of the business interests of the parties involved, without necessarily taking the broader public interest into account.

The following discussion concerns the actions of OPTA under the old framework. The Telecommunications Act formerly distinguished slightly different markets for the designation of SMP operators, as compared with the old European Framework: besides

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[143] See the Act implementing the European regulatory framework for the electronic communications sector 2002 (Wet implementatie Europees regelgevingskader voor de elektronische communicatiesector 2002), Stb. 2004, 189.

the first three markets (mobile, fixed, and leased line network and services),[144] it named the combined market for both fixed and mobile public telephone services in which a mobile operator can be designated as having SMP.[145] As the Act omitted any reference to interconnection as a separate market, no mobile operator could be designated as an SMP operator in this market. Therefore, under the old regulatory regime, OPTA (Dutch regulatory authority, Independent Post and Telecommunications Authority) had no power to impose specific obligations associated with an SMP designation on mobile operators with regard to interconnection, e.g., cost orientation. However, like regulatory authorities in the other Member States, OPTA was concerned about the high mobile termination tariffs (MTA) in the case of fixed to mobile interconnection. It has therefore conducted an inquiry, on the basis, of which it has formulated its policy concerning mobile termination rates.

With regard to call termination, OPTA held that it considers call termination as a bottleneck facility. In its view, mobile termination access is a separate market[146] and every mobile provider holds a monopoly position on it own network.[147] As on the basis of the current legislation OPTA is unable to designate a mobile operator as a SMP operator, it has instead relied firstly, on the general duty to interconnect addressed, in accordance with the TA, to all telecom operators and, secondly, on its dispute resolution powers to impose price control regulation with regard to MTA. OPTA constructed the duty to interconnect as a duty to which a principle of reasonableness applies. In other words, in OPTA's interpretation, an obligation to interconnect includes an obligation to offer reasonable mobile termination tariffs (i.e., cost-oriented tariffs including a reasonable return). MTA tariffs which are excessively high (above costs) compared to

[144] Article 6.4 (1) TA.

[145] Article 6.4 (2) TA.

[146] NMa, the Dutch competition authority, has come to the same conclusion in its Rapportage over de Marktdefenitie van het afwikkelen van gespreken op mobiele netten, NMa 01.08.2002, para. 80.

[147] Paras 20-22, Policy rules regarding the regulation of mobile terminating tariffs, 28 March 2002, OPTA/IBT/2002/2200802.

interconnection tariffs of fixed operators cannot be considered reasonable and therefore, an operator who maintains them is in breach of the obligation to interconnect. Furthermore, MTA tariffs are part of interconnection agreements with regard to which OPTA has dispute resolution powers. At the request of the parties, OPTA is authorised to resolve disputes between operators about the conformity of their interconnection agreements with the law. It resolves the dispute by a decision in which it can lay down the rules which will become part of the interconnection agreement.[148] As far as interconnection with mobile communications networks is concerned, OPTA was seized with a number of disputes between the various operators present on the Dutch market. Basically, it means that while OPTA, under the current Dutch law, has no power to regulate MTA tariffs neither by means of a general normative measure nor using a SMP concept, it has tried to use its ad hoc dispute resolution powers to adjust termination charges of mobile operators.

Based on the above premises, OPTA has published Policy rules regarding the regulation of mobile termination tariffs in which it pointed out that it would assess the reasonableness of the interconnection charges of mobile operators using the method of the so-called best-practice benchmark.[149] For the purposes of price control, OPTA has divided Dutch mobile operators into two groups depending on their market position KPN Mobile and Vodafone being subject to a lower MTA tariffs compared to T-Mobile, Orange and O_2. In the Policy rules, the maximum reasonable MTA tariff is defined on the basis of the MTA tariffs applied by the best-performing mobile operators in Europe who are not subject to cost orientation requirement. OPTA established that the MTA tariffs should be reduced gradually in two stages, after which (July 1, 2003) it intended to apply principle of cost orientation as a criterion for assessment of the reasonableness of the MTA tariffs.[150] OPTA further indicated that it considered a bottom–up FLLRIC approach

[148] Article 6.3 (1) and (2) TA.

[149] Para. 43, Policy rules

[150] Para. 50, ibid.

as the most appropriate basis for the cost allocation model for determination of a cost-oriented MTA charge.[151]

It is noteworthy that the Dutch competition authority (NMa) had also started an investigation concerning MTA tariffs, on the ground that they could represent an abuse by mobile operators of a dominant position in violation of Article 24 of the Dutch Competition Law (Mw). That investigation resulted in Report on the market definition for call termination on mobile networks.[152] However, the NMa decided not to proceed with its enquiry further since in the meantime OPTA published its Policy rules and commenced its practice of rendering decisions by which it effectuated tariff reduction, in context of resolution of disputes between telecom operators. In accordance with the Cooperation Protocol[153] concluded between OPTA and the NMa, in case of concurrence between regulatory powers of OPTA and the NMa the former has a priority as a sector-specific regulator provided it takes measures pursuant to TA and the NMa agrees that the measures eliminate the competition law concern.

In its Report, the NMa came to a conclusion similar to OPTA's regarding the relevant market for call termination.[154] However, in its non-binding Recommendation to OPTA,[155] the NMa indicated that while it would also apply cost orientation as a basis for the assessment of the MTA tariffs it would not use a FL-LRIC model. Instead, the mobile operators would be able to recover all their historic costs plus a reasonable rate of return.

OPTA has applied the above mentioned Policy rules to resolve numerous disputes between operators. However, its authority to do that had been challenged by the mobile

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[151] Para 49, ibid.

[152] NMa (2002), Rapportage over de marktdefenitie van het afwikkelen van gesprekken op mobiele netten, 1 augustus 2002.

[153] Cooperation Protocol, 19 December 2000.

[154] Paras. 51 and 71ff, NMa (2002).

[155] NMa Reactie op de beleidregels inzake de regulering van de MTA-tarieven, zaaknummer 2574, 27. 03.2003.

operators before courts. In November 2002, the appeals judge of the district court of Rotterdam suspended by its provisional ruling a number of OPTA's decisions by which the latter resolved disputes regarding mobile termination tariffs.[156] The judge based its ruling on the following considerations: firstly, he stated that OPTA seemed to have exceeded its dispute resolution authority when it imposed on categories of mobile operators general rules on MTA tariffs formulated in its policy document without taking into considerations and analysing specific circumstances surrounding each individual dispute.[157] This kind of general authority is more pertinent to competition law enforcers, such as the NMa. Secondly, the judge emphasised that the assessment of whether the termination tariffs were excessively high and therefore, would be in violation of the general duty to interconnect should be made on a case by case basis paying due regard to the position of the parties and the terms of their contractual relationship which may compensate for high termination rates. Thirdly, the judge questioned the legal basis for the requirement of cost-orientation with regard to MTA, because the law envisaged such obligation only in case of operators with SMP.

It is a pity that the final judgement rendered in this case by the Rotterdam court[158] did not deal with the assessment of the legality of OPTA's decisional practice on MTA or with other substantive issues which were raised in the provisional ruling discussed above. It granted the claim of mobile operators and annulled OPTA's decisions on purely formal grounds: the decisions were rendered in disputes between mobile operators which formally did not have direct contractual relationships on the basis of an interconnection agreement and which, moreover, had been granted a special exemption from the duty to

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[156] Voorzieningen rechter, Rechtbank Rotterdam, 29 November 2002, Reg. nr. VTELEC 02/2675 RIP, Dutchtone et al v. OPTA.

[157] As mentioned earlier, under the old Telecommunications Act of 1998, dispute settlement was to be conducted in the light of the business interests of the parties involved, and as such there was little room to adopt a general policy (in the light of the general interest) which would perhaps neglect the specific interests of the parties involved in each dispute.

[158] Rechtbank Rotterdam, 25 April 2003, Reg.nr. TELEC 02/2156 GERR and 02/2339 GERR, O2 and KPN Mobile v. OPTA.

interconnect directly. The OPTA has lodged an appeal against the judgement which is now pending before the Regulatory Industrial Organisation Appeals Court. In practical terms, however, the immediate effect of the judgement is that now more than 30 OPTA decisions on tariff reduction adopted in conformity with its Policy rules appear to lack proper legal ground and are hence unenforceable.[159]

In a last twist to this story, the Dutch Competition Authority, the NMa, which had been involved in this case all along, decided to pick up where OPTA had left. It re-opened the investigation mentioned previously into possible abuses of dominant position in the setting of the MTA tariffs. The NMa has already indicated that it would follow the same line of argument as OPTA, namely that termination on each mobile network is a separate relevant market, on which the network operator is by definition in a dominant position. For the NMa, excessive MTA tariffs can constitute an abuse of that dominant position and lead to a range of remedies, including the obligation to apply cost-oriented tariffs. In the light of these developments, the Dutch mobile operators "voluntarily" offered to lower their MTA tariffs,[160] whereupon the NMa terminated its case.[161]

Ironically, the new Dutch Telecommunications Act, in accordance with the new EC framework, does not make a distinction between direct and indirect interconnection.[162] Instead of the generally applicable obligation to interconnect, the new Act speaks about a broader obligation to achieve end-to-end connectivity (interoperability) by whatever technical means and arrangements the operators may choose.

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[159] Bitton (2003).

[160] Presumably, they estimated that the NMa would be in a position to take a decision against them (and see it survive judicial review). In that situation, it might be preferrable to make a voluntary commitment and avoid a formal negative decision.

[161] See "OPTA en NMa: bellen naar mobiel wordt fors goedkoper", Press Release (5 December 2003), available at www.nmanet.nl.

[162] See Article 6.1, TK 2002-2003, 28851.

4.3.2 Australia

The Australian experience in regulating the issues of fixed-to-mobile interconnection tariffs represents an interesting example of light-handed sector-specific regulation which differs in some respects from the approach adopted in the European Community and the majority of the EC Member States. The Australian legislative framework which is relevant in the context of access and interconnection is formed by the Telecommunications Act 1997, the Trade Practices Act 1974 hence: (the Act) and the Telecommunications Competition Act 2002. The Australian Competition and Consumer Commission (ACCC) is a body that exercises control over the telecommunications sector as far as the access obligations[163] and competition in the telecommunications sector are concerned.

Under the Act,[164] the standard access obligations are applied with regard to the telecommunications services "declared" by the ACCC in accordance with Section 39 of the Telecommunications Act 1997.[165] The objective of the ACCC declarations is three-fold: promoting competition in telecommunications markets, achieving any-to-any connectivity and encouraging efficient use of and investment in the telecommunications infrastructure.[166] The mobile (GSM) termination services have been declared by the ACCC.

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[163] Note that, as was outlined above, interconnection is a specific type of access.

[164] Section 152 AR, Trade Practices Act 1974.

[165] In the discussion of Australian law, the terms "declare", "declaration", etc., will refer to a declaration under s. 39 of the Telecommunications Act 1997, which can be seen as the functional equivalent of a finding that a relevant market must be analysed and that there is SMP, under the new EC regulatory framework.

[166] Section 152 AB (2), Trade Practices Act 1974.

Maintaining the standard access obligations is aimed at promoting the long-term interests of end-users. The standard access obligations require that the declared services should be made available by the provider of such services at the request of other operators seeking the access. Thus, the access obligations ensure the rights of third parties to gain access to the facilities/services which are necessary for them in order to supply their services to their own customers.

Hence, fixed-to-mobile and mobile-to-mobile interconnection must be provided by the mobile operators who are in control of termination calls to their subscribers. At present, there is no direct regulation of fixed-to-mobile termination charges in Australia. However, the ACCC has used its dispute resolution powers to introduce a soft form of regulation, discussed further below, in the form of principles which it intends to apply in the course of settling disputes concerning mobile termination prices.

The terms and conditions of interconnection, including interconnection tariffs, are subject to commercial negotiations. If parties are unable to reach an agreement on interconnection terms and conditions, either party may appeal to the ACCC with the request to resolve their interconnection dispute. The ACCC is required to issue a written determination of rights and obligations of the parties who wish to settle settling their disputes by means of arbitration.[167] In arbitrating access disputes, the ACCC has to take into account such factors as the interests of end-users, the legitimate business interests of the service provider, the interests of the access seeker, cost and technical conditions associated with the provision of access, and the economic efficiency of the provision of access.[168]

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[167] ACCC (2003), "Resolution of Telecommunications Access Disputes - A Guide to Dispute Resolution Provisions under Part XIC of the Trade Practices Act 1974 and the Telecommunications Act 1997", last revised May 2003.

[168] ACCC (2001), "ACCC Pricing Methodology for the GSM Termination Service", Final Report, July 2001.

At a certain point, seven access disputes had been submitted to the ACCC for arbitration. All of these disputes focused, inter alia, on the parties' disagreement with regard to mobile termination.[169] Under the Act, arbitration proceedings, in which the operators disputes are heard, are private and so are not open to public. Nevertheless, to ensure consistency of its decisional practice and to inform all interested parties on its policy in arbitrating interconnection disputes, the ACCC has formulated pricing principles in its Final Report on Pricing Methodology for the GSM Termination Services of July 2001 and its Final Report on Pricing Methodology for the GSM and CDMA Termination Services of September 2002, which it intends to apply to determine fixed-to-mobile termination tariffs in interconnection disputes submitted to it. The ACCC has expressly excluded mobile to mobile termination charges from its Pricing Methodology as not warranting regulatory intervention.[170]

The ACCC has established that basically two features of the mobile termination service create a situation in which mobile operators can charge termination tariffs which are significantly above costs of providing termination service: firstly, the ability of mobile operators to exercise control over termination calls to their subscribers, and secondly, consumer ignorance with regard to the costs of calling mobile subscribers. While the ACCC did not exclude that a number of factors could mitigate these two problems of the mobile termination service (transit arrangements, countervailing power of fixed-line operators, closed user groups and call back), it found that the competitive forces would, initially, too relatively weak to eliminate concerns about above-cost fixed-to-mobile termination prices.[171] It is interesting to note that, in its analyses of relevant product markets, the ACCC did not define mobile termination as a separate market.[172] On the one hand, it considered mobile termination as one of the components of the mobile services market which includes wholesale and retail functional elements.[173] On the other hand, the

[169] Ibid., Appendix A.

[170] Ibid., p. 5.

[171] Ibid, para. 4.2.4, p. 19.

[172] ACCC (2003b), p. 41.

[173] ACCC (2001), para. 5.1.1, p. 31.

fixed-to-mobile services market was regarded by the ACCC as a related retail downstream market of the mobile services market.[174]

The pricing methodology currently used by the ACCC as the most appropriate for the mobile termination service is retail benchmarking. According to this approach, each mobile operator's termination charges are correlated with the retail price of its overall mobile package (including access and outgoing calls).[175] This method uses the lowest existing freely negotiated termination price as a starting point. This termination price is then subject to gradual reduction at a rate corresponding to the rate of the decrease of retail prices. Apparently, the choice in favour if this approach was influenced by the expectation that retail prices (which are believed to be subject to healthy competition pressure and to reflect efficiency improvements) would continue to fall and, therefore, termination prices would be driven down towards cost. As the ACCC noted, if this expectation did not materialise, the retail benchmarking approach would not work.[176]

The ACCC pricing principles outlined above have never been applied in practice, though the ACCC claims that they have served a useful purpose in encouraging parties to settle their disputes over termination tariffs in view of the most probable arbitrated outcome which would otherwise follow from the ACCC.[177] It is noteworthy that all seven termination access disputes submitted to the ACCC withdrawn: four at an early stage and the remaining three following the publication of the ACCC Final Report on Pricing Methodology. Nevertheless, the ACCC now also questions whether the retail benchmarking approach would have been effective (i.e., ensure a continuing decrease of mobile termination charges) had it been applied in practice, since one of the essential presumptions on which the ACCC pricing principles are based, namely, that retail prices

[174] Ibid., para. 5.2.1(d), p. 45.

[175] Ibid., para 7.4, p. 75.

[176] Ibid., para.7.5, p. 78.

[177] ACCC (2003b), para. 5.1.2, p. 30; ACCC (2001), p. 78.

would continue to fall, did not eventuate,[178] which makes the retail benchmarking approach inoperable.

Currently, the ACCC is conducting a review of markets for mobile telecommunications services to assess the need for regulatory intervention in a number of mobile markets, that is, whether mobile termination service should continue to be declared under the Telecommunications Act 1997, and the appropriate form of regulation. As far as mobile termination is concerned, the Commission basically has to establish whether this service should remain declared. As already noted, the ACCC can only regulate mobile termination access including its price terms if the mobile termination service is declared under the Act. Moreover, in contrast to the current practice of developing pricing principles related to fixed-to-mobile interconnection tariffs on an ad hoc basis, under the Trade Practices Amendment (Telecommunications) Act 2001,[179] the ACCC is now under an obligation to formulate pricing principles with regard to declared services as soon as possible after the declaration has been made or varied. One of the major criteria on the basis of which the service can be declared is promotion of competition. The ACCC therefore has to identify the market(s) in which this objective can be achieved. So far, the ACCC has been reluctant to see mobile termination as a separate market.[180]

Provided that the mobile termination service remains declared, the ACCC has to determine the appropriate form of its regulation. In its Mobile Service Review 2003, the ACCC has put forward a number of possible approaches to mobile termination charges, such as retail benchmarking, cost-based methodology (TSLRIC-total service long-run incremental cost, LRIC in combination with price caps, short-run marginal cost), or

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[178] On the contrary, they appeared to increase over the period during which the ACCC monitored mobile operators retail prices for the purposes of implementation of the retail benchmarking pricing principles. See ACCC (2003b), para. 5.1.6, p. 49.

[179] Section 152AQA.

[180] ACCC (2003b), para. 5.1.5, p. 41.

'retail-minus avoidable costs' (RMAS) pricing. In particular, the ACCC has pointed out that, in the past, despite the fact that it considered TSLRIC to be the most appropriate pricing principle, it ultimately preferred to use the retail benchmarking method instead because the cost of implementation of a cost-based methodology appeared to outweigh its benefits.[181]

In June 2004, the ACCC published its new Decision on mobile termination access services, in the wake of the Mobile Services Review.[182] In its Decision, the ACCC concludes that it would be in the long-term interests of end-users to maintain the declaration of mobile termination services. In essence, the ACCC finds that all mobile operators have market power on termination over their respective network. Its observation of the market leads it to conclude that termination prices are excessive, which has a negative impact on competition on the markets for mobile-to-mobile and fixed-to-mobile calls. Furthermore, the ACCC believes that regulation of mobile termination promotes an efficient use of, and investment in, infrastructure, since excessive termination prices tend to reduce the consumption of fixed-to-mobile calls and induce excessive investment in mobile infrastructure (in particular handsets). Like Ofcom, the ACCC chooses to leave 3G services unregulated, however. With respect to remedies, the ACCC proposes to abandon its retail-minus approach to pricing, in favour of a target price based on estimates of the cost of providing mobile termination. This target price is to be reached in 2007 through a series of phased reductions.

[181] Ibid., para. 5.1.6, pp. 50-51.

[182] ACCC (2004), "Mobile Services Review: Mobile Terminating Access Service: Final Decision on whether or not the Commission should extend, vary or revoke its existing declaration of the mobile terminating access service", June, Melbourne.

4.4 Concluding remarks

We have seen that regulators and competition authorities have concluded that call termination on individual mobile networks are relevant markets. Given the EU regulatory framework, the presence of the risk of abuse is sufficient to intervene – there is no need to demonstrate an actual occurrence of abuse.

The typical way to deal with call termination monopolies within the European regulatory framework seems to be to 'revert' to cost-based prices by means of price controls. Although this looks like a logical approach at first sight, it is questionable. Gual (2004) argues that

> "[...] market definition in mobile call termination should not be mixed up with the issue of whether a regulation of termination charges is required."
> (Gual, 2004, p. 62.)

In particular, note that exercising market power may not be an undesirable if one adopts a welfare perspective. It is therefore unfortunate that regulatory frameworks or competition law procedures seem to be biased towards price controls to deal with 'excessive' mark-ups.[183] Such a regulatory reflex risks to be dealing with symptoms at a local level, without having performed a diagnosis from a broader, welfare perspective. In chapters 5 and 6 we will see that a priori, it is uncertain that there is a disease that needs a cure. This is because the excessive use of market power is typically assessed within narrowly defined markets, but without sufficient consideration to the interactions between wholesale and retail markets, and between the fixed and the mobile sector.

[183] See Larouche (2004).

5 Analysis based on economic models

As discussed in chapter 4, call termination on individual mobile networks are generally considered to be relevant markets, on which operators have 100% market share. Within the EU regulatory framework, the risk of potential abuse is sufficient to intervene, as there is no need to demonstrate an actual occurrence of abuse. To assess whether remedies are needed, and if so, which ones, however, one has to make a welfare assessment that goes beyond the relevant market, as this market is closely linked with the overall markets for fixed and mobile telephony.

This chapter contains an economic analysis of fixed-to-mobile network interconnection based on economic models. It is organized as follows. Section 5.1 summarizes some central results from the literature on access in telecommunications markets and surveys the literature on call termination on mobile networks. Section 5.2 provides additional results from numerical simulations. The model is presented in subsection 5.2.1, while results are presented and discussed in subsection 5.2.3. In the models discussed in sections 5.1 and 5.2, the issue of cost recovery was ignored. To address this issue, section 5.3 extensively deals with Ramsey pricing and the recovery of fixed and common costs. Section 5.4 concludes the chapter.

5.1 Welfare analysis based on models from the literature

In the early days of liberalization in telecommunications markets, one-way access probably posed the main regulatory problem. The central question was the level of the access price faced by entrants. Should this price be regulated? Given the bottleneck nature of local access, the incumbent may have an incentive to set the access price at a level so high that it makes entry unattractive. This problem is also known as foreclosure in an unregulated market. To prevent foreclosure, regulation of the access price may be needed. Other considerations with regard to the access price included the incumbent's possibilities to recover investments and entrants' incentives to invest in their own networks.

The theory of optimal access pricing was initially developed within a static context, focusing on allocative efficiency and ignoring the relationship between regulation and investment decisions of entrants.[184] Whereas in the short run, entry by firms without or with partial networks may be desirable, policy makers typically aim at promoting investments in infrastructure. A low access price, however, stimulates entry and competition in services, but mutes entrants' incentives to roll out their own networks. To stimulate entry competition in networks, it may therefore be necessary to adopt a dynamic access pricing rule, one that encourages entrants to invest. This can for instance be done by increasing the maximum access price over time according to a prespecified schedule (see Cave et al., 2001, for an extensive, policy-oriented discussion).

The first papers on two-way access focused on a symmetric setup corresponding to a mature market with competing operators, in which foreclosure is not an issue because operators are in a reciprocal situation. Nevertheless, the literature showed that there may

[184] A complete survey of the economics of access is beyond the scope of this report – the reader may wish to consult Armstrong (2002) and Laffont and Tirole (2000) for excellent surveys, based on formal, theoretical approaches, as well as more detailed references to the literature. Vogelsang (2003) contains a less formal overview.

be a role for regulation, because an access price for network interconnection above marginal costs leads to an inefficient situation of double marginalization. Also, in certain cases the access price may be used as an instrument of collusion, leading to inflated retail tariffs (see Armstrong, 1998, Carter and Wright, 2000, and Laffont, Rey and Tirole, 1998). The latter effect occurs if operators compete in linear prices (i.e., they charge per-minute prices but no subscription fees). If they compete in two-part tariffs, then access mark-ups do not affect profits at all. This result is known as 'profit neutrality'.[185] [186]

Most of the results obtained in the seminal papers cannot be directly applied to the transition phase in telecommunications markets, in which competition is still developing. In an infant market, in which entrants are still small, the asymmetry between an incumbent and an entrant gives rise to a problem related to the foreclosure problem in one-way access situations. As long as the entrant's customer base is still small relative to the market share of the incumbent, the entrant's customers will relatively often make calls to subscribers of the incumbent. Hence, the entrant needs to purchase access from the incumbent much more often than the other way around. If the incumbent charges a high access price for terminating calls on its network, it increases the entrant's perceived marginal cost, and substantially weakens the entrant's competitive position. The incumbent, on the other hand, is much less affected by an increase in the access price charged by the entrant. The reason is that a small entrant generates only little incoming traffic for the incumbent.[187] To stimulate entry, policy makers may therefore temporarily want to regulate the termination access price charged by the incumbent, while allowing entrants to charge an access mark-up, according to a pre-specified schedule.[188]

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[185] In section 5.2, we encounter the same result in a more general setting of interconnected fixed and mobile networks.

[186] It is beyond the scope of this report to summarize the literature on one-way and two-way access. The interested reader can consult Vogelsang (2003) for a concise overview of the regulatory problems and solutions suggested in recent literature in economics. Armstrong (2002) contains a more formal (i.e. model-based) overview.

[187] This depends on the nature of calling patterns.

[188] See De Bijl and Peitz (2002, 2004).

Recently, several papers and reports on mobile call termination have been published. Armstrong (2002) contains an extensive overview of economic theory on the topic.[189] A nice feature of that paper is the use of a simple model that incorporates several extensions in a stepwise fashion, relating them to (and incorporating insights from) other papers in the literature. While Armstrong's paper provides a reference point with regard to economic theory, other papers (which will also be discussed in chapter 6) are much more geared towards policy debates. Marcus (2004) considers the economic frameworks under which call termination fees are implemented in the US compared to the EU, the salient point being the absence of CPP in the US. Crandall and Sidak (2004) assess whether regulators should regulate access prices for mobile call termination. Newbery (2004) demonstrates the importance of taking into account the fixed and common costs of networks when considering socially optimal access charges. Littlechild (2004) discusses the effects of CPP versus RPP on mobile access prices.

To start with, a basic model and various adaptions analyzed in Armstrong (2002) are presented and discussed. Similar results and welfare implications were derived by Wright (2002). We will adopt Armstrong's notation and go through his model in detail. We start with a benchmark model. Subsequently, in various adaptations, some assumptions of this model will be relaxed.

Benchmark model (Armstrong, 2002)

There is a fixed and a mobile market. The size of each market is normalized to 1 (remark: the markets do not overlap). There are $n \geq 2$ identical mobile operators, and one fixed operator. The mobile and fixed networks are all interconnected. There are no fixed costs of network rollout, so recovery of fixed cost does not come into play (see the next subsection for a discussion on that topic).

[189] Armstrong discusses mobile call termination ('competitive bottlenecks') as a bridge between one-way and two-way access. Vogelsang (2003) views it as a special case of two-way interconnection.

Each mobile operator charges a subscription fee f_i and a per-minute price p_i (subscripts will be suppressed when prices are identical for all operators). Operator i's market share, which depends on all mobile operators' prices in the retail market, is denoted by $S_i(p_1,..., p_n; f_1 ,..., f_n)$. Because of competition, the market share function S_i is decreasing in p_i and f_i, and increasing in the prices p_j and f_j set by all other operators $j \neq i$. [190] The demand for mobile subscriptions is inelastic, that is, these tariffs do not affect the total number of mobile subscribers. Mobile users' individual demand for calls is denoted by $q(p)$. All their calls terminate on the fixed network.[191] Demand $q(p)$ is decreasing in p. The net utility of a mobile customer equals $v(p) - f$, where $v'(p) = - q(p)$. Mobile operators incur fixed cost k per subscriber (say, the cost of supplying the customer with a handset), marginal cost c^0 for off-net calls, and marginal cost c^T for terminating calls. The access price for call termination on mobile network i is denoted by a_i. Operator i's profit function, which will be defined later, is denoted by $\pi_i (p_i, f_i ; a_i)$.

The fixed sector is regulated (e.g. because competition in fixed telephony is still ineffective), such that customers pay a per-minute price P for calls to mobile users. Fixed subscribers' aggregate demand for calls to mobile users is denoted by $Q(P)$; since the total number of mobile subscribers is normalized to be equal to one, Q also denotes the number of calls received per mobile user.[192] Demand $Q(P)$ is decreasing in P. The net surplus of fixed consumers is equal to $V(P)$, where $V'(P) = - Q(P)$. Regulation of the fixed sector also includes a termination access price (for calls incoming from the mobile networks) equal to zero. Since P may depend on the access price for mobile call termination a_i, on network i, sometimes the notation $P(a_i)$ will be used. We will sometimes assume that P is regulated at the level of total marginal costs, that is, $P(a_i) = C$

[190] For the purposes of this analysis, it is not necessary to specify in detail how competition between the operators affects market shares.

[191] This assumption simplifies the exposition. It will be relaxed in section 5.2, where we will look at both fixed-to-mobile as well as mobile-to-mobile off-net calls.

[192] Without loss of generality, calls that remain on the fixed network are left out of the picture.

+ a_i, where C denotes the marginal cost of a fixed-to-mobile call up to the point of interconnection with a mobile network. Note that fixed callers may not know to which network a mobile user subscribes, but they do know the per-minute price of calling that user. The fixed operator's profits are denoted by $\Pi(P)$.

- There is a fixed market (with 1 operator) and a mobile market (with 2 competing mobile operators). The fixed and mobile networks are all interconnected.
- The demand for mobile subscriptions is inelastic.
- All calls made by mobile users terminate on the fixed network.
- The mobile operators compete by choosing two-part tariffs. The fixed operator's prices are regulated.
- Mobile users are not charged for receiving calls, and derive not utility from receiving calls.

Box 5.1: Summary of the benchmark model.

Given P, a mobile user receives $Q(P)$ calls from the fixed sector. Mobile subscribers do not pay for being called, that is, the calling party pays (CPP). Accordingly, mobile operator i's profits per customer are equal to:

$$\pi_i (p_i, f_i ; a_i) = S_i(p_1,..., p_n; f_1 ,..., f_n) [(p_i - c^0) q(p_i) + f_i - k + (a_i - c^T) Q(P(a_i))].$$

Assuming that the mobile sector is perfectly competitive, the net utility of mobile users is maximized subject to the constraint $\pi_i = 0$ for all operators.[193] Therefore, in a symmetric equilibrium, in which each operator charges the same access price a,

$$p^* = c^0 \text{ and } f^* = k - (a - c^T) Q(P(a)).$$

[193] This assumption is not restrictive. Wright (2002) obtains similar results as Armstrong (2002) by assuming imperfect competition.

Note that the termination access price only affects mobile users' subscription fee, not the per-minute price, which is set at the marginal-cost level.[194] One can readily observe that if the access price is above marginal cost (i.e. $a > c^T$), then mobile handsets are offered at prices below the fixed cost per subscriber (i.e. $f^* < k$). In other words, operators subsidize mobile phones.

In a symmetric equilibrium, and under the assumption that there are no call externalities (i.e., mobile users attach no value to being called) and mobile users do not care about the utility of the persons that call them, each mobile operator will set access prices at the monopoly level:[195]

$$a^* = \text{argmax}_a \, \pi(p, f; a) = \text{argmax}_a \, (a - c^T) \, Q(P(a)).$$

Since a^* satisfies the first-order condition $Q(P(a)) + (a - c^T) \, Q'(P(a)) = 0$, where $Q(\cdot) > 0$ and $Q'(\cdot) < 0$, one can see that $a^* > c^T$, that is, the profit-maximizing access price is higher than the marginal cost of termination access. Note that because of perfect competition, the access price has no effect on an operator's overall profits.

Summarizing, without regulation, each mobile operator makes zero overall profits because of perfect competition, but nevertheless maximizes revenues from termination on its network. The effect is that the rents from termination access – which are financed by fixed callers – are not eliminated by competition in the retail market, but transferred from mobile operators to their customers.

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[194] A similar result would also be obtained if calles made by mobile users would not all go to the fixed sector. In particular, per-minute prices would then be set equal to 'perceived' marginal costs, which takes into account the access charges for mobile-to-mobile calls.

[195] For instance, operators simultaneously choose access prices. The same result is obtained if operators can coordinate on, or ajointly determine, the access price.

To determine the welfare-maximizing access price, assume that other fixed services are not affected by changes in the fixed-mobile retail price.[196] Welfare is then measured by the sum of the net utility that fixed subscribers obtain from calling mobile users, and the total net utility of mobile subscribers (mobile operators make zero profits, since there is perfect competition in the mobile market):[197]

$$\begin{aligned} W(a) &= V(P(a)) + v(c^0) - f \\ &= V(C + a) + v(c^0) + (a - c^T)\, Q(C + a) - k. \end{aligned}$$

One can easily show that welfare is maximized if access is priced at the marginal cost level, that is,

$$\hat{a} = \text{argmax}_a\, W(a) = c^T.$$

The central observation in this model is that $a^* > \hat{a}$, that is, operators will set an access price that is above the socially efficient access price, even if there is perfect competition in the retail market. The consequence is that without regulation, the retail price $P(a^*)$ is inflated compared to the social optimum, leading to reduced demand and hence underconsumption of fixed-to-mobile voice calls. Hence, regulation of the access price (assuming that regulation can be fully effective) is desirable from a social point of view.[198] To understand this benchmark result, notice that mobile users benefit from a mark-up in the access price, since it translates into lower subscription fees. Nevertheless, their benefits, subsidized by the fixed market, do not outweigh the reduction in the net utility of fixed subscribers. A cost-based access price eliminates any distortion in their calling behavior. Furthermore, note that a consequence of the assumption of perfect

[196] A consequence of this assumption is e.g. that fixed subscribers do not switch to a mobile subscription if they are dissatisfied with the high retail price of calling mobile customers.

[197] Without loss of generality, we can abstract from the fixed operator's profits, which are regulated at a fixed level.

[198] This result does not depend on the intensity of competition in the mobile sector.

competition in the mobile market is that a^* maximizes the surplus of mobile subscribers – a result that does not survive under imperfect competition.

The model demonstrates that even if mobile operators make monopoly profits from call termination, it may be the case that intense competition at the retail level fully dissipates these profits. That is, any excess profits from termination access are offset by retail prices below costs. Even if excess access revenues are competed away, welfare is reduced due to distorting effects on consumers' behavior.

It is interesting to verify how the benchmark result might change if certain assumptions are adapted. Armstrong (2002) explores various adaptations of the basic model, which are presented below.

Adaptation 1: RPP

Suppose that the price for receiving calls is not a priori fixed at zero because of some convention, while the calling party still pays a price for call originiation. Thus, whereas the receiving party now pays a reception charge, the calling party still pays a price for making calls. Also, mobile users have to accept all incoming calls. Let fixed consumers pay a per-minute price P. Think of P as the price for call transmission up to the point of interconnect. If P is equal to marginal cost, then $P = C$. Mobile subscribers to network i pay a per-minute price a_i for incoming calls (also called reception charge). Assuming that mobile users cannot refuse incoming calls, having them pay for receiving calls does not distort welfare; it just leads to a transfer from the mobile user to its network operator. Note that market shares now also depend on termination access prices. The profit function of mobile operator i becomes:

$$\pi_i (p_i, f_i ; a_i) = S_i (p_1,..., p_n; f_1 ,..., f_n; a_1 ,..., a_n) \\ [(p_i - c^0) q(p_i) + f_i - k + (a_i - c^T) Q (P)].$$

In equilibrium, $p^* = c^0$, and because any profits are competed away, $f^* = k - (a - c^T) Q(P)$. The profit-maximizing price for incoming calls a^* maximizes $(a - c^T) Q(P)$ subject

to $f = k - (a - c^T)\, Q(P)$. Welfare can be written as $W(a) = V(P) + v(c^0) + (a - c^T)\, Q\,(P) - k$. It follows directly that the socially optimal access price is equal to the price charged by the operators, that is, $\hat{a} = a^*$. Furthermore, given that mobile consumers do not value incoming calls, the socially optimal per-minute price for fixed calls equals $P = C + c^T$. The crucial observation from this adaptation of the benchmark model is that introducing RPP may eliminate the need of cost-based access regulation.[199] Nevertheless, as will be discussed in chapter 6, it may be necessary to enforce an access price of zero, in order to induce mobile operators to introduce reception charges (see also Wright, 2002).

The result above suggests that combining CPP with RPP will eliminate the need for regulation of access prices. RPP introduces a concern on the part of mobile users about the level of access prices and therefore stimulates mobile operators to reduce them. This is confirmed in a paper by Doyle and Smith (1998), who show that under RPP, mobile operators compete on reception charges to gain market share. Nevertheless, RPP introduces some new concerns, such as the possibility that mobile users will switch off their handsets. As will be discussed in chapter 6, such concerns do not seem to be of great importance.

The theoretical insights on competition under RPP are still in development. The welfare effects of RPP in terms of call efficiency are analyzed in Kim and Lim (2001) and Jeon et al. (2004), who both show that positive reception charges can improve welfare. More specifically, Jeon et al. analyze a situation of two competing operators and address whether reception charges (the prices paid by called parties) can lead to the social optimum, which is obtained by the maximization of the total surplus from calls (net of

[199] The results are somewhat different in a 'pure' RPP regime, where callers do not have to pay at all. As competition drives profits down to zero, mobile operators choose subscription fees and the access price so that they recover their fixed costs. This introduces an upperbound on the unregulated access price that effectively solves the call termination problem. A negative side-effect is that the per-minute price of fixed consumers is too low, as it no longer covers the cost of access. The presence of call externalities may balance this distortion to a certain extent (Armstrong, 2002). Thus both CPP and RPP distort welfare, but in different ways.

costs) when callers as well as called parties derive utility from calls.[200] If reception charges are regulated, it can be shown that there exists an equilibrium that implements the social optimum. The reception charge may not be too large, however, to make sure that called parties do not hang up. The authors also analyze the case in which reception charges are set noncoooperatively by the operators. One can show that the termination access price can be chosen such that there exists an equilibrium that approximates the social optimum. Intuitively, reception charges introduce an additional instrument contributing to the internalization of the call externality.[201] [202]

Adaptation 2: elastic demand for mobile subscriptions + network externalities

Suppose that the demand for mobile subscriptions is elastic, which implies that the total number of mobile subscribers may vary with tariff (p, f). In particular, suppose that the number of mobile subscribers increases with the net surplus offered by mobile operators. Since an access mark-up leads to a subscription fee below cost, that is, $f < k$, it also leads to a larger number of mobile subscribers. Assume that the utility of fixed consumers is increasing in the number of mobile subscribers, for there are more persons that can be called (there is a 'network externality'). Accordingly, an access mark-up increases the

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[200] In their model there is no separate segment that is interconnected to the competitive segment, so that the results may not immediately apply to the case of interconnected networks.

[201] Jeon et al. also show that if operators can apply network-based price discrimination, operators have strong incentives for 'connectivity breakdown', i.e., to choke off-net traffic by setting high reception charges or per-minute prices for off-net calls.

[202] Hermalin and Katz (2004) look at socially optimal origination and reception charges in the case of a single network while it is assumed to be given that the caller and called party subscribe to this network. Given these assumptions, their results are more difficult to translate to our setting. They derive results on the socially optimal level of the sum of the origination and the reception charge. Under specific assumptions, they show that prices that equally divide the cost between sender and receiver are socially optimal. They also consider a waiting game in which each party can decide to either send a message or wait for the other party to send one ('two-way calling'). Again it is shown that an equal split of the cost may lead to larger welfare than does CPP.

utility of fixed customers, since it indirectly inflates the number of mobile users that can be called by them. Nevertheless, Armstrong (2002) shows that the welfare-maximizing access price $\hat{a}$ is below the unregulated monopoly price, but it may be above marginal cost. Summarizing, $c^T \leq \hat{a} < a^*$. The socially optimal level of the access price may be higher than in the model without the network externality, but optimal regulation of the access price still improves welfare.

Wright (2002) builds on the standard model in which the size of the mobile market is given, by allowing for the possibility that more aggressive pricing in the mobile retail market leads to a higher penetration rate of mobile telephony. In Wright's model, there is no network externality. Let w_i denote the net surplus enjoyed by a consumer subscribing to mobile operator i, that is, $w_i = v(p_i) - f_i$. By using a random discrete utility model in the spirit of Anderson et al. (1992) and normalizing the outside option to zero, it can be shown that operator i's market share is equal to:

$$S_i(p_1,..., p_n; f_1 ,..., f_n) = (e^{w_i / \rho}) / (1 + e^{w_1 / \rho} + ... + e^{w_n / \rho}),$$

where parameter ρ represents the intensity of competition between the mobile operators (the operators offer perfect substitutes as ρ approaches zero). The result that the access price does not affect an operator's profit level (obtained in the benchmark model) no longer holds. An increase in the access price has two effects. First, it results in higher access revenues, which boosts profits. Second, it results in a higher penetration of mobile telephony because of the resulting downward pressure on subscription fees. This effect also increases profits. Wright shows that mobile operators will choose the same access price a^* as in the benchmark model, that is, the monopoly price. Moreover, the welfare-maximizing access price $\hat{a}$ is larger than the marginal cost of access c^T but lower than the unregulated access price. Summarizing, $c^T < \hat{a} < a^*$.

Adaptation 3: call externalities

Suppose that mobile subscribers benefit from receiving calls (there is a 'call externality'). Each call minute generates utility $b > 0$, and the net utility of a mobile subscriber equals $v(p) + b\,Q\,(P(a)) - f$. Profit-maximizing operators will choose the access price such that it maximizes $(a - (c^T - b))\,Q(C + a)$.[203] This implies that the unregulated access price a^* is typically lower than in the benchmark case.[204] Furthermore, given that $P(a) = C + a$, welfare can be written as

$$W(a) = V(C + a) + v(c^0) + b\,Q\,(C + a) + (a - c^T)\,Q\,(C + a) - k.$$

It is straightforward to show that $\hat{a} = c^T - b$ and $a^* > \hat{a}$. Thus, the presence of call externalities reduces the socially optimal access price as well as the unregulated access price, compared to the benchmark case. Intuitively, the utility obtained from receiving a call increases a mobile user's total benefits from having a subscription. Decreasing the access price indirectly results in fixed subscribers making more calls to mobile users, and hence raise the surplus offered to mobile users. Just as before, access regulation (again under the assumption that it is effective and has no negative side effects) improves welfare.

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[203] This expression is derived from maximizing mobile users' net utility subject to the zero-profits constraint.

[204] Because of the implicit-function rule, in the benchmark model we have that $\mathrm{d}a^*/\mathrm{d}c^T = [Q'(C+a) / (2Q'(C+a) + (a - c^T)Q''(C+a))]$. A sufficient condition for $\mathrm{d}a^*/\mathrm{d}c^T$ to be increasing is that $a - c^T$ is not too large while $Q''(\cdot) > 0$. In the adapted model, if $Q(P) = m - r\,P$ then $a^* = Q(C - (c^T - b)) / 2r$, compared to $a^* = Q(C - c^T) / 2r$ in the benchmark. Note that in this example, $\hat{a}$ is reduced with b while a^* is reduced with $b/2$, so that the need for regulation of the access price becomes stronger compared to the benchmark.

Adaptation 4: internalization of fixed users' utility by mobile users

Suppose that mobile callers care about the people who call them to the extent that they fully take into account the welfare of their callers when they choose a mobile network.[205] Because the mobile sector is perfectly competitive, the total net utility of mobile and fixed users is maximized subject to the constraint $\pi_i = 0$ for all mobile operators. Therefore, in equilibrium, retail prices are equal to $p^* = c^0$, $f^* = k - (a - c^T)\ Q\ (P(a))$. Moreover, profit-maximizing operators will set $a^* = c^T = \hat{a}$. In this situation, there is no market failure, and hence regulation of the access price is not needed. In intermediate cases, in which mobile subscribers attach more weight to their own utility then to the benefits of those calling them, the access price set by operators is still inflated, although less than in the benchmark situation (see Wright, 2002).

Adaptation 5: substitution between fixed and mobile connections

So far, it was implicitly assumed that there is no substitution between fixed lines and mobile subscriptions. Now suppose that some consumers have both a fixed and a mobile subscription, so that they can choose when making a call.[206] Then an increase in the fixed-to-mobile price P affects the profits generated in the fixed market. Note that this could happen anyway if P is not equal to $C + a$. Also, note that mobile operators will take into account that a lower access price leads to a larger mobile market, an effect that introduces downward pressure on a^*. Implicitly it is assumed that access is charged for off-net mobile-to-mobile calls as well (the issues discussed here did not arise earlier since it was assumed that there were no mobile-to-mobile calls). Welfare can be written as

$$W(a) = \Pi(C + a) + V(C + a) + v(c^0) + (a - c^T)\ Q(C + a) - k.$$

[205] Wright (2002) incorporates this assumption by assuming that mobile users, in addition to the earlier specified utility level, derive utility that is proportional to the utility of fixed users.

[206] In reality, it may of course happen that some users abandon their fixed connections and only subscribe to a mobile operator.

The socially optimal access price satisfies $\hat{a} = c^T - \Pi'(C + \hat{a}) / Q' (C + \hat{a})$. In particular, if $\Pi'(C + \hat{a}) > 0$ then $\hat{a} > c^T$. This situation may occur if the profit reduction from a higher fixed-to-mobile price is overcompensated by an increase in the demand for other services on the fixed network, such as fixed-to-fixed calls. If this is the case, the discrepancy between the socially optimal access price and the monopoly access price becomes smaller. Reversely, $\Pi'(C + a) < 0$ implies that $\hat{a} < c^T$. This situation may occur if fixed consumers who face a higher price for calls to mobile users, use their mobile telephone instead of their fixed connection, so that fixed profits are reduced. Overall, it is unclear whether the discrepancy between $\hat{a}$ and a^* is reduced.[207]

Adaptation 6: customer ignorance or oversimplified tariffs

The benchmark model and the five adaptations above show that it is the application of CPP that introduces a basic distortion in the allocation of costs between fixed and mobile users. It is interesting to briefly discuss another potential source of distortion, namely consumer ignorance (Gans and King, 2000), which can equivalently be seen as a situation in which the fixed operator sets a price based on average access prices, that is, $P = C + \Sigma_i (s_i a_i)$, where s_i is the share of calls terminating on i's network.. The ACCC (2002) argues that end-users who want to call a mobile user, may know the various access prices charged by mobile operators, but often do now know the access price charged by the operator to whom the called party subscribes.[208] Suppose that fixed consumers are not aware of the mobile network they are calling nor of the price for a given call to a mobile network. As a consequence, they may base their calling behavior on an average per-minute price for fixed-to-mobile calls. This introduces a free-rider effect, as an individual mobile operator who raises its own access price does not experience the full reduction in demand which is caused by such a price increase. A lack of consumer awareness therefore contributes to an operator's market power with respect to termination access.

[207] An interesting, more elaborate extension would be the case in which fixed and mobile subscriptions are perfect substitutes. If, at some point, all fixed users switch to mobile phones, the problem of call termination could vanish.

[208] Calls to relatives and calls within closed user groups may be exceptions to this observation.

Ignoring the possibility that regulation may be costly or ineffective, this provides an additional argument in favor of access regulation (within the assumptions that were made).

The following table summarizes the results of the basic model and its adaptations. Note that the model adaptations are applied in a separate fashion, not incrementally.

Model and adaptations	**Results and comparison with benchmark***
0. Benchmark model with CPP	a^* > marginal cost of access $\hat{a}$ = marginal cost of access There is a discrepancy ($a^* - \hat{a}$)
1. RPP (called party pays for termination; calling party still pays a price for origination)	a^* undetermined $\hat{a} = a^*$ No discrepancy ($a^* - \hat{a}$)
2. Elastic demand for mobile subscriptions + network externalities (utility of fixed users is increasing in size of mobile market)	$\hat{a} \geq$ marginal cost of access $a^* > \hat{a}$ Discrepancy ($a^* - \hat{a}$) weakly decreases
3. Call externality (mobile users benefit from receiving calls)	a^* decreases $\hat{a}$ decreases (possibly to larger extent than the reduction in a^*) There is a discrepancy ($a^* - \hat{a}$)
4. Internalization of fixed users' utility by mobile users (mobile users care about people who call them)	a^* = marginal cost of access $\hat{a}$ = marginal cost of access No discrepancy ($a^* - \hat{a}$)
5. Substitution between fixed and mobile subscriptions	a^* decreases (compared to benchmark) $\hat{a}$ may increase or decrease Discrepancy ($a^* - \hat{a}$) may increase or decrease
6. Customer ignorance (fixed users are ignorant about prices for calls to mobile users) or oversimplified tariffs	a^* > marginal cost of access $\hat{a}$ = marginal cost of access Discrepancy ($a^* - \hat{a}$) increases

* a^* denotes the unregulated access price; $\hat{a}$ denotes the welfare-maximizing access price.

Table 5.1: Summary of theoretical results.

Concluding, a central insight from the analysis above is that without CPP, regulation is not needed. Moreover, the adaptations of the benchmark model discussed above suggest that in some cases, an access price above marginal cost may be optimal for welfare. For instance, a case for an access mark-up was made in the model with network externalities: if the market for mobile telephony is not yet mature (in the sense that some people do not yet have mobile phones), it may be welfare-improving to have fixed callers subsidize mobile subscribers.[209] In general, however, arguments that support an access mark-up do not imply that the access price should not be regulated at all. The reason is that mobile operators will choose the access price such that profits per subscriber are maximized. At the margin, a lower access price does not affect mobile operators' profits, but it does lead to higher welfare because the fixed-to-mobile price is reduced (Wright, 2002). The latter effect is ignored by mobile operators when they choose the access price. Therefore, in a situation with CPP, ignoring fixed cost recovery and assuming that regulation is effective and not very costly to implement, it is typically desirable to regulate the access price for call termination on the mobile networks. Without such regulation, there is a distortion in the sense that fixed users pay too much when they call mobile subscribers, while mobile users are heavily subsidized. In section 5.3, we will discuss the welfare implications in a setting in which fixed and common costs need to be recovered.

[209] It should be noted that as mobile telephony tends towards market saturation, the need for a subsidy from the fixed to the mobile market is reduced. The high and increasing penetration rate in the EU (81% in 2003) does not seem to support an argument in favor of subsidies between the markets.

5.2 Additional welfare analysis based on numerical simulations

In this section, we will assess some of the results discussed in the previous section in a set-up that allows for more fine-tuned and detailed outcomes, and for additional insights. To do so, we construct a somewhat richer and more complex model, which we solve by numerical simulations. The model depicts interconnection between the fixed market, in which there is a single network operator, and the mobile sector, in which two mobile operators compete with each other.[210] The fixed operator is a monopolist and its wholesale and retail prices are regulated at cost levels. The mobile operators are horizontally differentiated. They compete by choosing retail prices (we consider both linear prices and two-part tariffs). At the outset, mobile termination charges are given, for instance because of access regulation or because operators jointly agree on them before they compete in the retail market. CPP applies.

The model is different to the benchmark model of Armstrong (2002), discussed in the previous section, in several ways. Whereas Armstrong only analyzes competition in two-part tariffs in the mobile sector, we also consider competition in linear prices. Furthermore, Armstrong assumes that all calls made by mobile subscribers terminate on the fixed network. Here we allow for calls between all types of subscribers and networks, according to a structure of 'uniform calling patterns'. This means that each call is directed to any other consumer, whether on-net or off-net (and in the latter case, whether directed to a fixed or mobile subscriber) with equal probabilities. These probabilities are proportional to operators' customer bases. Also, in Armstrong's model, there is perfect competition in the mobile sector. Here we assume that there is imperfect competition because of horizontal differentiation between mobile operators.

[210] The model explored here is an extension of the model of facilities-based competition in De Bijl and Peitz (1994). To depict a situation of mobile call termination, a fixed operator that interconnects with the mobile operators (taking into account the implied traffic volumes between the fixed and mobile sector) has been incorporated.

5.2.1 The model

In the fixed sector, there is a single operator, denoted as operator 0. The prices (both wholesale and retail) of this operator are regulated. In the mobile sector, two operators, denoted as operator 1 and 2, compete in the retail market by simultaneously setting retail prices (see below for the way wholesale prices are determined). In reality, it may be the case that one of the mobile operators is integrated with the fixed operator. Since we will assume that the fixed operator is completely regulated such that it breaks even, adapting the model so that the fixed operator is integrated with, say, mobile operator 1, does not change the insights that are obtained.

The mobile users are uniformly distributed on the interval [0,1]. Operator 1 is located at $l_1 = 0$, and operator 2 at $l_2 = 1$. A mobile user located at z who subscribes to operator i incurs a disutility $\sigma \mid l_i - z \mid$, where $i = 1, 2$. Parameter $\sigma > 0$ is inversely related to the intensity of competition. The parameters of the model will be chosen such that all mobile consumers participate.

The size of the fixed sector is equal to n_{fixed}, while the size (or more precisely: mass) of the demand side in the mobile sector equals n_{mobile} consumers in the mobile sector. The size of the overall market equals $n = n_{\text{fixed}} + n_{\text{mobile}}$.

Two cases of price competition will be considered. In the case of 'two-part tariffs', operator i charges a per-minute price p_i and a subscription fee m_i, $i = 1, 2$. In the case of 'linear pricing', operator i only sets a per-minute price p_i. In the latter case, the description of the model below still applies by assuming that $m_i = 0$, $i = 1, 2$.

Operator 0 charges a subscription fee m_0 and per-minute prices p_{0i}, $i = 0, 1, 2$, where p_{00} denotes the price for an on-net call, and p_{0i} the price for an off-net call to mobile operator i.

Let c_{ij} denote operator i's traffic-dependent (i.e., marginal) cost for on-net calls (denoted by $j = 1$), off-net calls ($j = 2$), and incoming calls ($j = 3$), ignoring the access charges that may be incurred. Operator i's traffic-independent cost per customer is denoted by f_0. The termination access prices charged by operator i for a call originating on operator j's network is denoted by τ_{ji} (note that the sequence of j and i depicts the direction of the call set-up from network j to network i). We abstract from all costs that are traffic-independent and customer-dependent, in particular the fixed and common costs of networks.[211]

Fixed subscribers' individual demand for call minutes priced at p is denoted by $x_0(p)$, while fixed users' utility of calling x minutes is $u_0(x)$. Assuming that $u_0(x) = a_0\, x - ½\, b_0\, x^2$, we obtain a linear demand $x_0(p) = (a_0 - p) / b_0$. Similarly, mobile consumers have a quadratic utility function $u(x)$ and an individual demand function $x(p) = (a - p) / b$.

A fixed user's indirect utility from making a call priced at p_{0i} will be written as $v_0(p_{0i}, m_0) = k_0 + u_0(x_0(p_{0i})) - x_0(p_{0i})\, p_{0i} - m_0$. Similarly, mobile users' indirect utility from subscribing to operator $i = 1, 2$, will be written as $v(p_i, m_i) = k + u\,(x(p_i)) - x(p_i)\, p_i - m_i$. Parameters k_0 and k denote traffic-independent utility levels (the utility obtained from having a connection, for instance because one can be reached by others). Fixed users maximize their utility by choosing the appropriate number of calls to make.[212] Mobile users maximize their utility by subscribing to one of the mobile operators and then choosing the appropriate number of calls. While doing so, consumers take operators' retail prices as given.

[211] Including such costs in the model will not affect the insights, since they do not affect equilibrium outcomes.

[212] The fixed operator's subscription fee will be regulated such that all fixed users subscribe.

Since the fixed operator's prices are regulated, we will write market shares and profit functions as functions of the mobile operator's retail prices only. It is straightforward to show that mobile operator *i*'s market share is equal to

$$\varphi_i(p_1, p_2, m_1, m_2) = 1/2 + [v(p_i, m_i) - v(p_j, m_j)] / (2\sigma), \text{ where } j \neq i \text{ and } j = 1, 2.$$

Calling patterns are assumed to be uniform, that is, although consumers do care about making calls, they are indifferent about whom they call, in the sense that they determine randomly whom to call. That is, when a consumer makes a call, the called consumers may be any other consumer (subscribing to the fixed operator or to either mobile operator) with equal probability. An implication of this assumption is that the volumes of on-net and off-net traffic are proportional to market shares and segment sizes.

Adding up the revenues from on-net calls, off-net calls, incoming calls, and subscriptions, and taking into account the calling patterns between the different groups of customers, one can write the fixed operator's profits as[213] [214]

$$\begin{aligned}\Pi_0(p_1, p_2, m_1, m_2) = \; & (n_{\text{fixed}} / n) \; [\; x_0(p_{00}) \; n_{\text{fixed}} \; (p_{00} - c_{01}) \\ & + \; x_0(p_{01}) \; \varphi_1 \; n_{\text{mobile}} \; (p_{01} - c_{02} - \tau_{01}) \\ & + \; x_0(p_{02}) \; \varphi_2 \; n_{\text{mobile}} \; (p_{02} - c_{02} - \tau_{02}) \\ & + \; \varphi_1 \; x(p_1) \; n_{\text{fixed}} \; (\tau_{10} - c_{03}) \\ & + \; \varphi_2 \; x(p_2) \; n_{\text{fixed}} \; (\tau_{20} - c_{03}) \;] \; + \\ & n_{\text{fixed}} \; (m_0 - f_0).\end{aligned}$$

Similarly, the mobile operator's profits are equal to

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[213] To keep the expressions readable, retail prices are suppressed in the market share functions.

[214] For more background on the construction of the profit functions, see, e.g., Armstrong (1998) and Laffont et al. (1998).

$$\Pi_1(p_1, p_2, m_1, m_2) = (n_{\text{mobile}} / n) [\, x(p_1)\ \varphi_1^2\ n_{\text{mobile}}\ (p_1 - c_{11})$$
$$+\ x(p_1)\ \varphi_1\ \varphi_2\ n_{\text{mobile}}\ (p_1 - c_{12} - \tau_{12})$$
$$+ x(p_1)\ \varphi_1\ n_{\text{fixed}}\ (p_1 - c_{12} - \tau_{10})$$
$$+ \varphi_2\ x(p_2)\ \varphi_1\ n_{\text{mobile}}\ (\tau_{21} - c_{13})$$
$$+ n_{\text{fixed}}\ x_0(p_{01})\ \varphi_1\ n_{\text{mobile}}\ (\tau_{01} - c_{13})\ ] +$$
$$n_{\text{mobile}}\ \varphi_1\ (m_1 - f_1),$$

and

$$\Pi_2(p_1, p_2, m_1, m_2) = (n_{\text{mobile}} / n) [\, x(p_2)\ \varphi_2^2\ n_{\text{mobile}}\ (p_2 - c_{21})$$
$$+\ x(p_2)\ \varphi_2\ \varphi_1\ n_{\text{mobile}}\ (p_2 - c_{22} - \tau_{21})$$
$$+ x(p_2)\ \varphi_2\ n_{\text{fixed}}\ (p_2 - c_{22} - \tau_{20})$$
$$+ \varphi_1\ x(p_1)\ \varphi_2\ n_{\text{mobile}}\ (\tau_{12} - c_{23})$$
$$+ n_{\text{fixed}}\ x_0(p_{01})\ \varphi_2\ n_{\text{mobile}}\ (\tau_{02} - c_{23})\ ] +$$
$$n_{\text{mobile}}\ \varphi_2\ (m_2 - f_2).$$

Consumers surplus in the fixed sector is equal to

$$(n_{\text{fixed}} / n)\ [n_{\text{fixed}}\ v_0(p_{00}, m_0) + \varphi_1 n_{\text{mobile}}\ v_0(p_{01}, m_0) + \varphi_2 n_{\text{mobile}}\ v_0(p_{02}, m_0)],$$

and in the mobile sector it can be written as

$$(n_{\text{fixed}} / n)\ [\varphi_1\ v(p_1, m_1) + \varphi_2\ v(p_2, m_2) - (\sigma / 2)\ (\varphi_1^2 + \varphi_2^2)].$$

Welfare is defined as the sum of consumers and producers surplus (we will distinguish between welfare in the two sectors). In the tables that report the outcomes of the analysis, consumers surplus will be denoted by *CS*, producers surplus by *PS*, and welfare by *W*.

Operator 0's subscription fee m_0 is regulated at the level of traffic-independent costs f_0. Its per-minute prices p_{0i}, $i = 0, 1, 2$, are regulated at the level of traffic-dependent costs. Hence the price for an on-net call is $p_{00} = c_{01}$, while the price for an off-net call to mobile network $i = 1, 2$ equals $p_{0i} = c_{02} + \tau_{0i}$.

To solve the model, we look for a Nash equilibrium in the mobile operators' retail prices p_1, p_2, m_1 and m_2 (in the case of two-part tariffs) or in retail prices p_1 and p_2 (under linear pricing). To do so, the fixed operator's prices, and all mobile termination access prices will be taken as given, the latter prices either because of regulation or because the mobile operators can agree on them before they compete in the retail market. Since we are mainly interested in the effect of different levels of access prices on consumers surplus and welfare, the process according to which access prices are determined will not be considered further.

The model has been programmed in *Mathematica*.[215] The core of the program is a numerical procedure based on Newton's method, a procedure which is applied to solve the system of first-order conditions that define a Nash equilibrium in the mobile retail market.[216]

To solve the model numerically, all parameters must get numerical values. The problem is, however, that data is unavailable. Mobile operators typically do not calculate the marginal (or long-run incremental) costs associated with specific parts of their networks or with different wholesale services, and if they would do so, they view this information as highly sensitive because of competition concerns.[217] The same is the case for data about demand functions and elasticities. Therefore the model has to be calibrated by using educated guesses for plausible values of the parameters. Fortunately, the type of

[215] The simulation programs are available on request.

[216] For further details see De Bijl and Peitz (2002), Appendix 3.2.

[217] Private communication with KPN Mobile and Vodafone Netherlands.

model that we use delivers qualitatively robust results.[218] The parameter values that were used to obtain numerical outcomes can be found in table 5.2 below.

With regard to the model parameters, note the following.

1. All parameters with a monetary connotation (all cost parameters; regulated price levels; demand parameters a, a_0, k_0, and k) are in Euro-cents.

2. In order to keep the results 'clean' from asymmetries between the two sectors (about which no data is available in any case), it is assumed that the fixed and mobile sector exhibit symmetric cost and demand characteristics.

3. Demand parameters are chosen such that for a per-minute price equal to 0, a consumer would call 1,000 minutes, and for a per-minute price equal to 19 cents, a consumer would call 50 minutes.

[218] It is straightforward to check that by running the model under different parameter constellations, the qualitative implications of the model do not change within wide ranges of plausible parameter values. Of course, the parameters need to be within reasonable ranges to deliver outcomes with meaningful interpretations. Different parameter constellations do change the outcomes in a quantitative sense, but since the model is not meant to provide an accurate picture of the market, this is not a major problem. See also De Bijl and Peitz (2002, p. 56).

Parameter	Interpretation	Value
n_{fixed}	size of fixed sector	10,000,000
n_{mobile}	size of mobile sector	10,000,000
σ	measure of horizontal differentiation in mobile sector	2,000
k	traffic-independent utility level from subscribing to a mobile operator	2,000
a	demand parameter of mobile users	20
b	demand parameter of mobile users	0.02
k_0	traffic-independent utility level from subscribing to fixed operator	2,000
a_0	demand parameter of fixed users	20
b_0	demand parameter of fixed users	0.02
c_{i1}, $i = 1, 2$	operator i's marginal cost of an on-net call	10
c_{i2}, $i = 1, 2$	operator i's marginal cost of an off-net call	5
c_{i3}, $i = 1, 2$	operator i's marginal cost of an incoming call	5
f_i, $i = 1, 2$	operator i's fixed cost of a single connection	1,000
c_{01}	operator 0's marginal cost of an on-net call	10
c_{02}	operator 0's marginal cost of an off-net call	5
c_{03}	operator 0's marginal cost of an incoming call	5
f_0	operator 0's fixed cost of a single connection	1,000
m_0	operator 0's subscription fee	f_0
p_{00}	operator 0's per-minute price for on-net calls	c_{01}
p_{0i}, $i = 1, 2$	operator 0's per-minute price for off-net calls to operator i's customers	$c_{02} + \tau_{0i}$
τ_{ij}, $i = 0, 1, 2$ and $j = 1, 2$	access price for calls from operator i to mobile operator j	varied (see tables with output)
τ_{i0}, $i = 1, 2$	access price for off-net calls from operator i to operator 0	c_{03}

Table 5.2: Parameter values.

5.2.2 Simulation results

Simulation results are obtained in two different situations of competition in the mobile market. In the first one, operators compete in two-part tariffs (consisting of subscription fees and per-minute prices which are linearly related to usage). In the second one, they compete in linear prices (i.e. per-minute prices only). In reality, however, mobile operators offer menus of a variety of contracts, for instance to distinguish themselves from other operators, and to apply implicit price discrimination. In these menus, many contracts have a more complex pricing structure than a two-part tariff or a linear price. Unfortunately, with the type of model explored here, incorporating that operators compete by offering menus of contracts would render the model virtually intractable. Hence we explore two relatively simple pricing modes and, by comparing the possible differences in model outcomes, will try to draw more general conclusions.

The results that are derived highlight the different consequences of mark-ups in access prices for fixed-to-mobile (F2M) and mobile-to-mobile (M2M) calls. In current practice, mobile operators typically do not make a distinction between F2M and M2M access prices, which effectively results in uniform F2M and M2M charges. However, as Rey and Jullien (2004) argue, F2M and M2M call termination exhibit fundamentally different characteristics. For instance, M2M access prices can be used as an instrument of tacit collusion. In addition, if mobile operators are asymmetric in the sizes of their customer bases, then increases in the M2M access prices of large operators slow down the growth of smaller rivals. These effects do not occur with regard to F2M access prices. The key issue there is that F2M termination gives rise to wholesale monopolies on individual networks. It is therefore worthwhile to consider F2M as well as M2M access mark-ups, and to compare them to the current practice of uniform F2M and M2M mark-ups.

First, suppose that mobile operators competing in two-part tariffs. Table 5.3 depicts simulation outcomes.

situation characterized by:	*no access mark-ups*	*uniform F2M and M2M access mark-ups*		*F2M access mark-ups only*		*M2M access mark-ups only*	
τ_{ij}, i,j=1,2	5	7.5	10	5	5	7.5	10
τ_{0i}, i=1,2	5	7.5	10	7.5	10	5	5
p_i, i=1,2	10.00	10.62	11.25	10.00	10.00	10.62	11.25
m_i, i=1,2	3000	2238	1828	2531	2375	2707	2453
p_{00}	10.00	10.00	10.00	10.00	10.00	10.00	10.00
p_{0i}, i=1,2	10.00	12.50	15.00	12.50	15.00	10.00	10.00
m_0	1000	1000	1000	1000	1000	1000	1000
Π_i, i=1,2	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Π_0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CS (mobile)	100.0	145.9	158.6	146.9	162.5	99.0	96.1
W (mobile)	300.0	345.9	358.6	346.9	362.5	299.0	296.1
CS (fixed)	350.0	295.3	256.3	295.3	256.3	350.0	350.0
W (fixed)	350.0	295.3	256.3	295.3	256.3	350.0	350.0
CS (total)	450.0	441.2	414.8	442.2	418.8	449.0	446.1
PS (total)	200.0	200.0	200.0	200.0	200.0	200.0	200.0
W (total)	650.0	641.2	614.5	642.2	618.8	649.0	646.1

Prices are in cents; profit and surplus levels in millions (Euros).

Table 5.3: Competition in two-part tariffs: basic results on access mark-ups.

Table 5.3 illustrates the following effects of different types of access mark-ups:

1. Uniform (F2M and M2M) and M2M access mark-ups lead to increases in mobile per-minute prices and decreases in mobile subscription fees.
2. Mobile operators' profits are not affected by mobile access mark-ups ('profit neutrality').

3. Uniform (F2M and M2M) access mark-ups and F2M access mark-ups increase consumers surplus and welfare in the mobile sector. M2M access mark-ups have a reverse effect.
4. Uniform (F2M and M2M) and F2M access mark-ups reduce consumers surplus and welfare in the fixed sector. M2M access mark-ups do not affect the fixed sector.
5. All types of access mark-ups reduce total consumers surplus and total welfare.

Interestingly, mobile operators are indifferent about the level of termination access prices. [219] The background is that under competition in two-part tariffs, operators, for any level of access prices, set per-minute prices equal to perceived marginal costs and exercise any market power through subscription fees. Any revenues from access prices above marginal costs are competed away in the retail market through lower subscription fees. Thus the model illustrates the so-called 'waterbed' effect, as it is called in policy discussions in the UK.

With regard to surplus levels, one can make two central observations. First, F2M access mark-ups increase consumers surplus in the mobile sector at the expense of fixed consumers who 'pay the price'. Since mobile consumers' gain does not offset the surplus reduction in the fixed sector, such mark-ups reduce total welfare. Second, M2M access mark-ups do not affect fixed consumers, but do reduce consumers surplus in the mobile sector (for inflated per-minute prices distort calling behavior). Again total welfare is reduced. The effects of F2M access mark-ups on total surplus can also be observed if the

[219] This result is well known from the literature on facilities-based competition in telecommunications. See Laffont, Rey and Tirole (1998), and also Dessein (2003). Here we observe that profit-neutrality not only holds for M2M access prices (which corresponds to the results in the literature on facilities-based competition in situations of two-way access), but also to F2M charges. The profit-neutrality would not hold without reciprocity (M2M) or symmetry (F2M) of access prices, or if operators choose access prices unilaterally. In the latter case operators have strong incentives to increase any access price, as it increases profits and market share.

number of fixed subscribers is very small compared to the number of mobile subscribers. On the one hand, the reduction of surplus in the fixed sector would become much less significant, but on the other hand, the same holds for the increase of consumers surplus in the mobile sector.

Second, suppose that mobile operators compete in linear prices. Table 5.4 depicts simulation outcomes.

situation characterized by:	*no access mark-ups*	*uniform F2M and M2M access mark-ups*		*F2M access mark-ups only*		*M2M access mark-ups only*	
τ_{ij}, i,j=1,2	5	7.5	10	5	5	7.5	10
τ_{0i}, i=1,2	5	7.5	10	7.5	10	5	5
p_i, i=1,2	14.67	14.33	14.43	14.00	13.75	15.00	15.34
m_i, i=1,2	-	-	-	-	-	-	-
p_{00}	10.00	10.00	10.00	10.00	10.00	10.00	10.00
p_{0i}, i=1,2	10.00	12.50	15.00	12.50	15.00	10.00	10.00
m_0	1000	1000	1000	1000	1000	1000	1000
Π_i, i=1,2	12.2	34.8	42.9	33.4	39.9	12.5	12.2
Π_0	0	0	0	0	0	0	0
CS (mobile)	220.9	230.5	227.6	240.1	247.5	212.5	204.3
W (mobile)	245.4	300.1	313.5	306.9	327.3	237.5	228.7
CS (fixed)	350.0	295.3	256.3	295.3	256.3	350.0	350.0
W (fixed)	350.0	295.3	256.3	295.3	256.3	350.0	350.0
CS (total)	570.9	525.8	483.8	535.4	503.8	562.5	554.3
PS (total)	24.5	69.6	85.9	66.8	79.7	25.0	24.4
W (total)	595.4	595.4	569.7	602.3	583.5	587.5	578.7

Prices are in cents; profit and surplus levels in millions (Euros).

Table 5.4: Competition in linear prices: basic results on access mark-ups.

Table 5.4 illustrates the following effects of different types of access mark-ups:

1. F2M access mark-ups lead to lower mobile per-minute prices, and M2M access mark-ups to higher mobile per-minute prices. The effects of uniform (F2M and M2M) access mark-ups are mixed.
2. Uniform (F2M and M2M) and F2M access mark-ups increase mobile operators' profits. M2M access mark-ups have the same effect but to a much smaller extent and within a narrower range (due to choking off mobile customers' demand).
3. Uniform (F2M and M2M) access mark-ups and F2M access mark-ups increase consumers surplus and welfare in the mobile sector. M2M access mark-ups have a reverse effect.
4. Uniform (F2M and M2M) and F2M access mark-ups reduce consumers surplus and welfare in the fixed sector. M2M access mark-ups do not affect the fixed sector.
5. All types of access mark-ups reduce total consumers surplus. Uniform (F2M and M2M) and M2M access mark-ups reduce total welfare. F2M access mark-ups may increase or decrease total welfare.

Contrary to the situation with two-part tariffs, where mobile operators were indifferent, now their profit levels depend sharply on termination access prices. Accordingly, the 'waterbed' effect (the additional revenues from access mark-up are competed away in the retail market), observed if operators compete in two-part tariffs, does not occur.

To discuss the effects on surplus levels, we distinguish F2M and M2M access mark-ups. First, note that F2M access mark-ups increase consumers surplus and profits in the mobile sector at the expense of fixed consumers. The surplus gain in the mobile sector may or may not offset the surplus reduction in the fixed sector, so that the effect on total welfare can go either way. In particular, if the F2M access mark-up is not too high, total welfare may go up, as the aggregate effect on profits and consumers surplus in the mobile sector outweighs fixed consumers' loss in surplus. Second, again M2M access mark-ups

are neutral for fixed consumers, but do make mobile consumers worse off and reduce total welfare.

The results depicted in the two pricing situations (two-part tariffs and linear pricing) can be seen as extreme cases. In a situation of two-part tariffs, all access revenues are competed away in the retail market so that mobile operators' profits remain constant. Under linear pricing, access prices can be used as instruments of tacit collusion, since they increase mobile operators' profits.[220] While neither of the explored modes of price competition is fully realistic (mobile operators typically use menus of contracts in a world where customers are not identical), the fact that mobile operators seem to care a lot about termination revenues suggests that the linear-pricing model provides useful pointers to understand the nature of competition. In particular, economic theory suggests that the outcomes of competition when operators use menus of contracts to implement price discrimination, tend to resemble the results obtained under linear pricing.[221] With price discrimination, for instance, per-minute prices are typically set above (perceived) marginal cost levels, while operators leave some surplus to consumers. Accordingly, the profit-neutrality result in the model with two-part tariffs is unlikely to be realistic. Nevertheless, it is likely that operators (partly) use termination access revenues to reduce subscription fees and capture market share. That is, the 'waterbed' effect probably plays a role in reality, to a certain extent.

[220] This is a well-known result from the literature (Armstrong, 1998; Laffont et al., 1998).

[221] See Dessein (2003) for references and discussion.

5.3 Ramsey pricing and the recovery of fixed and common costs

In this section we discuss the recovery of fixed and common network costs. From a welfare viewpoint, the most natural way to guarantee cost recoupment is to set Ramsey prices, which are welfare-maximizing prices subject to the constraint that firms break even. To implement Ramsey pricing, data is needed, for instance about demand elasticities of various services. The report of the Competition Commission (2002, ch. 8) contains an extensive discussion of the limitations and inconsistensies of currently available demand data. This section is complementary to that discussion, as we focus on more conceptual issues related to Ramsey pricing, which, as far as we know, have not been discussed in detail in policy discussions or in the literature.

We will first explain what is meant by the concept of Ramsey pricing. The general problem in a world with fixed costs is that a 'second-best' solution, that is a solution in which prices deviate from marginal costs, needs to be found in order to recoup the fixed costs. The logical way to proceed is to determine the prices that maximize welfare subject to the cost recovery constraint. By definition, such prices are socially optimal (in a second-best way). This problem, known as Ramsey (or as Ramsey-Boiteux) pricing, can be formulated as follows.[222] Consider a regulated multi-product firm selling n goods (possibly wholesale as well as retail) at prices $p_1,..., p_n$. Its profit function $\Pi(p_1,..., p_n)$ depends on an underlying cost function $C(q_1,..., q_n)$, where $q_i = D(p_i)$ denotes the demand function of good i. The profit function can accordingly be written as $\Pi(p_1,..., p_n) = \Sigma_i \; p_i D(p_i) - C(D(p_1),...,D(p_n))$. Let $S_i(q_i)$ denote the gross consumers surplus of consuming a quantity q_i of good i. Hence welfare, which is equal to the sum of producers surplus and net consumers surplus, can be written as $W = \Sigma_i \; [S_i(D(p_i)) - C(D(p_1),...,D(p_n))]$. The social planner's problem is:

[222] See Laffont and Tirole (2000, section 2.2).

Determine prices $p_1,..., p_n$ that maximize welfare W, such that $\Pi(p_1,..., p_n) \geq 0$.

It can be shown that optimal prices, also called Ramsey prices, include mark-ups in all prices in such a way that the relative sizes of the mark-ups reflect underlying costs and demand characteristics:

$$\text{mark-up for good } i = (p_i - (\partial C/\partial q_i)) / p_i = (\lambda / (1 + \lambda)) / \eta_i ,$$

where η_i is the price elasticity of demand for good i and $1/\lambda$ is the shadow price of the zero-profit constraint. Accordingly, mark-ups should be proportional to inverse elasticities, or put somewhat differently, each individual price should be equal to the underlying marginal cost plus a 'Ramsey term'. If the price elasticity of demand η_i for product i is relatively low, then this mark-up will be relatively high, and vice versa. This pricing structure is known as the inverse elasticity rule, meaning that higher mark-ups are charged for goods with a lower price elasticity. Accordingly, mark-ups minimize the distortions in consumers' consumption decisions.

In the situation of mobile termination access, Ramsey pricing might lead to mark-ups in mobile access prices, for two reasons. The first reason is that the price elasticity of the demand for fixed-to-mobile calls is, according to some empirical studies, relatively low, so that a Ramsey mark-up is desirable.[223] The second reason is that since access mark-ups lead to reduced mobile subscription fees, they contribute to a fast expansion of the mobile market. As this enables fixed callers to reach more mobile users, social surplus is increased. Mobile users do not take this network externality into account when they decide to subscribe. However, given that the current-generation mobile market is mature,

[223] Different studies do not show consistent results, however. See Competition Commission (2002, ch. 8) for a critical discussion of empirical studies in the UK. Moreover, the elasticities faced by operators (firm-specific elasticities), which affect prices set by them, may be different from market elasticities, which are relevant for Ramsey pricing (par. 8.61 in Competition Commission, 2003).

the rationale for a 'network externality surcharge' has vanished. We will therefore focus on the first reason, related to the need for cost recovery.

A natural – and crucial – observation is that Ramsey pricing should be applied at an overall level to the mobile sector and the fixed sector.[224] The reason is that the interconnected fixed and mobile networks form a closely integrated system, leading to important interactions between the sectors (in particular because of call traffic and wholesale tradings between the two sectors). Since these interactions form the heart of the call termination problem, a priori they cannot be ignored. Note in particular that, given the prominent presence of fixed and common costs in the fixed sector, Ramsey mark-ups in the fixed market may be desirable from a welfare viewpoint.[225] Thus, just as Ramsey pricing in the mobile sector might imply that the fixed sector partly finances the costs of mobile networks, a reverse subsidy also makes sense; perhaps even more.[226]

In theory, the proper way to implement Ramsey pricing (in the sense that it truly leads to the second-best welfare outcome), is to regulate all prices, wholesale and retail, to ensure that they are set at the correct levels. There exist, however, more realistic ways of formulating the social planner's problem that, although unable to reach a true second-best outcome, still included elements of Ramsey pricing. In policy debates these different 'shades' of Ramsey pricing are typically not explicitly defined and discussed – all of

[224] See also Marcus (2004) and Valletti (2003). Jeon (2002) analyzes Ramsey pricing in a simple model of interconnected fixed and mobile networks.

[225] In a model of Ramsey pricing, Jeon (2002) assumes that only the fixed network incurs a fixed cost, and ignores fixed costs of mobile networks.

[226] What would happen the fixed operator also charges an access price above cost? Without presenting numerical results (which are straightforward to derive with the model of section 5.2), we note that introducing an M2F access mark-up decreases total welfare (it introduces a distortion) and it increases the fixed operator's profits. One could transfer this surplus partly to fixed customers, e.g. by decreasing the regulated subscription fee. Hence, an M2F access mark-up can compensate fixed customers for the loss in surplus caused by F2M access mark-ups.

them are put under the header of Ramsey pricing.[227] As a consequence, confusing statements and claims that may lack foundation are easily being made.

To clarify the discussion it is therefore useful to precisely write down the most obvious ways of defining the social planner's problem. We will do this by using the same notation as in section 5.2. Suppose that there are one fixed operator (operator 0) and two mobile operators (1 and 2). Operators choose non-linear, two-part tariffs. The fixed operator is allowed to use termination-based price discrimination, just as is typically the case in reality.[228] The subscription fee charged by operator $i = 0, 1, 2$ is denoted by m_i (if operators compete in linear prices, subscription fees are fixed to be zero). Each mobile operator $i = 1, 2$ sets a per-minute price p_i. The fixed operator sets a per-minute price p_{0i} for a call terminating on network $i = 0, 1, 2$. Market shares in the mobile market are $\varphi_i = \varphi_i(p_1, p_2, m_1, m_2)$, $i = 1, 2$. The individual demand for call minutes, given price p, is $x_0(p)$ for fixed users and $x(p)$ for mobile customers. The size of the fixed sector is normalized to 1, just as the size of the mobile sector. Let τ_{ij} denote the termination access price for a call originating on network i and terminating on network j. Parameter F_i denotes the fixed and common cost incurred by operator i. Parameters c_{ij} and f_i denote various levels of marginal costs and traffic-independent costs per customer, respectively. Consumers surplus in the fixed sector is denoted by CS_{fixed}, and consumers surplus in the mobile sector by CS_{mobile}. In a generic example that illustrates the intricate links between the fixed and mobile sector, which is obtained under assumptions that are typically used in telecommunications models, profit functions can be written as follows:[229] [230]

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[227] For instance, Competition Commission (2003, ch. 8) contains an extensive discussion on Ramsey pricing, but it does specify the social planner's optimization problem.

[228] Note that this is not the same as price discrimination in general.

[229] See section 5.2. The underlying model and the exact nature of the profit functions does not affect our discussion. This example allows for the presence call externalities.

[230] The deduction of fixed and common costs in the mobile operators' profit functions, as in the expressions above, is somewhat problematic due to the static nature of the depicted problem. The profit functions above depict revenues and costs in a single period of competition. If the time

$$\Pi_0 = (1/2)\,[\, x_0(p_{00})\,(p_{00} - c_{01}) + x_0(p_{01})\,\varphi_1\,(p_{01} - c_{02} - \tau_{01}) + x_0(p_{02})\,\varphi_2\,(p_{02} - c_{02} - \tau_{02}) + \varphi_1\,x(p_1)\,(\tau_{10} - c_{03}) + \varphi_2\,x(p_2)\,(\tau_{20} - c_{03})\,] + (m_0 - f_0) - F_0,$$

$$\Pi_1 = (1/2)\,[\, x(p_1)\,\varphi_1^2\,(p_1 - c_{11}) + x(p_1)\,\varphi_1\,\varphi_2\,(p_1 - c_{11} - \tau_{12}) + x(p_1)\,\varphi_1\,(p_1 - c_{11} - \tau_{10}) + \varphi_2\,x(p_2)\,\varphi_1\,(\tau_{21} - c_{13}) + x_0(p_{01})\,\varphi_1\,(\tau_{01} - c_{13})\,] + \varphi_1\,(m_1 - f_1) - F_1,$$

$$\Pi_2 = (1/2)\,[\, x(p_2)\,\varphi_2^2\,(p_2 - c_{21}) + x(p_2)\,\varphi_2\,\varphi_1\,(p_2 - c_{21} - \tau_{21}) + x(p_2)\,\varphi_2\,(p_2 - c_{21} - \tau_{20}) + \varphi_1\,x(p_1)\,\varphi_2\,(\tau_{12} - c_{23}) + x_0(p_{02})\,\varphi_2\,(\tau_{02} - c_{23})\,] + \varphi_2\,(m_2 - f_2) - F_2.$$

The social planner's problem of Ramsey pricing can now be written as follows:

Problem I: *Ramsey pricing (second-best outcome)*
Determine fixed access prices τ_{10} and τ_{20}; mobile access prices τ_{01}, τ_{02}, τ_{12}, and τ_{21}; fixed retail prices p_{00}, p_{01}, p_{02}, and m_0; and mobile retail prices p_1, m_1, p_2, and m_2, that maximize total welfare $W = \Pi_0 + \Pi_1 + \Pi_2 + CS_{\text{fixed}} + CS_{\text{mobile}}$, such that $\Pi_0 \geq 0$, $\Pi_1 \geq 0$, and $\Pi_2 \geq 0$.

Even though regulation of all prices may be too much to ask for in reality, the problem of Ramsey pricing (problem I) is the benchmark, or point of reference, that we will use to discuss less ambitious social goals. In practice it may be more realistic to assume that regulators can only control access prices in the mobile market, and have to leave the

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horizon is longer, say five years, and a single period amounts to, say, two months, then per-period profits need only partially contribute to the recoupment of investments. It may therefore be more accurate to include a 'per-period portion' of fixed and common costs in the per-customer fixed costs f_1 and f_2, and fix F_1 and $F2$ at zero.

determination of retail prices to the operators.[231] However, by doing so, a second-best welfare outcome may no longer be attainable. The social planner's problem of reaching a 'third-best' outcome can be written as follows:

Problem II: *Partial price controls with Ramsey elements (third-best outcome)*
Determine fixed access prices τ_{10} and τ_{20}; mobile access prices τ_{01}, τ_{02}, τ_{12}, and τ_{21}; and fixed retail prices p_{00}, p_{01}, p_{02}, and m_0, that maximize total welfare $W = \Pi_0 + \Pi_1 + \Pi_2 + CS_{\text{fixed}} + CS_{\text{mobile}}$, such that $\Pi_0 \geq 0$, $\Pi_1 \geq 0$, and $\Pi_2 \geq 0$.

In problem II, retail prices in the mobile sector, p_1, m_1, p_2, and m_2, are implicitly determined as the outcome of price competition between operators 1 and 2. The retail prices of the fixed operator, p_{00}, p_{01}, p_{02}, and m_0, are all regulated (as is typically the case in practice, one way or another), jointly with all access prices.[232]

By definition, the regulator has less grip in problem II than in problem I. Hence, denoting the welfare level that is obtained by solving problem k by W^k, we have that

$$W^{\text{I}} \geq W^{\text{II}}.$$

Policy discussions tend to focus on yet another way of characterizing the problem of Ramsey pricing (or rather incorporating Ramsey-style elements in price controls), namely by taking regulation of the fixed sector as given – determined in the past through a separate regulatory process – and restrict attention to the mobile sector. Accordingly, regulation of the fixed operator is left out of the problem. One can now define two

[231] The Commission Recommendation of the EC identifies three potentially troublesome (for competition purposes) markets in mobile telephony, all of which are wholesale markets (call termination is the most prominent one).

[232] Problem II is somewhat similar to the model in Jeon (2002, section 3), who derives Ramsey formulas if only the fixed network (and not the mobile networks) incurs a fixed cost.

additional problems, denoted as III and IV.[233] In problem III, mobile retail prices are explicitly included to be set at Ramsey levels. Since it differs in one dimension from problem I, problem III can, just as problem II, be said to lead to a third-best welfare outcome, although the resulting welfare levels may turn out to be different.

Problem III: *Partial price controls with Ramsey elements (third-best outcome)*
Suppose fixed access prices τ_{10} and τ_{20}, and fixed retail prices p_{00}, p_{01}, p_{02}, and m_0, are given. Determine mobile access prices τ_{01}, τ_{02}, τ_{12}, and τ_{21} and mobile retail prices p_1, m_1, p_2, and m_2, that maximize total welfare $W = \Pi_0 + \Pi_1 + \Pi_2 + CS_{\text{fixed}} + CS_{\text{mobile}}$, such that $\Pi_1 \geq 0$ and $\Pi_2 \geq 0$.

In problem IV, mobile retail prices are left to be determined by competition. Problem IV departs from the second-best outcome in two dimensions instead of the single dimension of problem II, and will therefore be said to lead to a fourth-best outcome.

Problem IV: *Partial price controls with Ramsey elements (fourth-best outcome)*
Suppose fixed access prices τ_{10} and τ_{20}, and fixed retail prices p_{00}, p_{01}, p_{02}, and m_0, are given. Determine mobile access prices τ_{01}, τ_{02}, τ_{12}, and τ_{21} that maximize total welfare $W = \Pi_0 + \Pi_1 + \Pi_2 + CS_{\text{fixed}} + CS_{\text{mobile}}$, such that $\Pi_1 \geq 0$ and $\Pi_2 \geq 0$.

Table 5.5 recapitulates the four welfare problems that were defined above.

[233] The regulatory regime in the fixed sector is assumed to be identical in problems III and IV.

The social planner...	*...sets all prices in the mobile sector*	*...only sets termination charges in the mobile sector*
...includes the fixed operator's prices in the optimization	Problem I welfare W^{I}	Problem II welfare W^{II}
..does not adjust the fixed operator's prices	Problem III welfare W^{III}	Problem IV welfare W^{IV}

Table 5.5: Overview of welfare problems.

Because the regulator has less grip (i.e., less variables to regulate at its disposal) in problem IV than in problem III, it must be that

$$W^{\mathrm{III}} \geq W^{\mathrm{IV}}.$$

The main, conceptual division between the four problems defined above is between, on the one hand, problems I and II, and on the other hand, problems III and IV. The dividing line consists of the decision whether or not to include the fixed sector in the welfare analysis. At each side of the dividing line, a choice can be made whether or not to regulate mobile retail prices. Taking the latter choice as given, what can be said about welfare levels in the two broad classes of problems? Suppose that one can ignore the fixed operator's zero-profit restriction, $\Pi_0 \geq 0$, for instance because it is not binding in problems I and II, and would not be binding in problems III and IV if taken into consideration.[234] Then, because the social planner has less instruments at its disposal in problems III and IV (compared to problems I and II, resp.), we have that

[234] This assumption facilitates further welfare comparisons of the problems and is unlikely to affect the generality of the discussion that follows. In reality, the fixed operator is typically regulated such that it makes a reasonable (and hence positive) return, so that its zero-profit constraint is not binding.

$W^{I} \geq W^{III}$ and $W^{II} \geq W^{IV}$.

If Ramsey considerations did not play a role in regulating the fixed sector, it is likely that $W^{I} > W^{III}$ and $W^{II} > W^{IV}$. In reality, the fixed sector is typically regulated because of the dominant position of the former incumbent, and prices are usually fixed at cost-based levels (including a reasonable return). These are completely different considerations. Hence it is quite unlikely that the fixed operator's prices, that are taken as given in problems III and IV, happen to coincide with the optimal prices that contribute to welfare maximization in problems I and II.

Does competition in the mobile market induce operators to set retail prices at Ramsey levels? More precisely, is it sufficient to only regulate the mobile operators' access prices at Ramsey levels, in order to obtain $W^{I} = W^{II}$ or $W^{III} = W^{IV}$? It is sometimes claimed that the answer is yes, because if competition is effective, operators will maximize the surplus of their customers.[235] How accurate is this claim? Note that competition in the mobile market is imperfect, as is typically the case in an oligopoly situation. Casual observation suggests that operators derive market power from various sources, such as consumer switching costs (e.g. frictions in number portability), horizontal differentiation (e.g. because of branding strategies), strategies targeting different niches (e.g. corporate versus individual customers), and price discrimination through menus of contracts (e.g. non-linear price schemes, prepaid phones and bucket plans). Thus, even if the claim that competing operators maximize their customers' surplus is true, it is uncertain that competition is sufficiently effective achieve this outcome. Assume, however, that competition in the mobile market is perfect. In the model with no externalities, fixing the

[235] See Competition Commission (2001, 8.66-8.67), summarizing a claim by Frontier Economics on behalf of Vodafone, which is motivated by referring to a result in Armstrong and Vickers (2001). However, the model in that paper does not directly apply to fixed-mobile interconnection. Newbery (2004) mentions, in a footnote, the view that overall competition would force operators to set Ramsey mark-ups for unregulated, competitive services (if the uncompetitive ones are regulated at Ramsey levels).

F2M termination tariff at the 'right' level (obtained from either problem I or III) would presumably take care of the connections between the fixed and mobile networks and of the fixed consumers' welfare. Regulation of the fixed sector should eliminate excessive profits in that sector, while (allegedly perfect) competition would do it in the mobile sector – and such a way that it maxizes CS_{mobile}. If there are call or network externalities, then the above logic fails, even if the F2M rate is set at the 'right' level that takes externalities into account.[236] A reasonable conjecture is therefore that $W^{\text{II}} < W^{\text{I}}$ and $W^{\text{IV}} < W^{\text{III}}$, that is, regulating mobile access prices at Ramsey levels without controlling retail prices can be expected to lead to an inferior welfare outcome. To summarize, the claim that competition for mobile subscribers will lead to Ramsey prices is hard to justify.[237]

The lesson from the discussion above is that allowing a small set of wholesale prices to include Ramsey-like mark-ups is unlikely to lead to a proper Ramsey pricing structure, and will probably not lead to the envisioned second-best welfare outcome. Without further analysis, the size of the gap between a proper Ramsey outcome and third- or even fourth-best outcomes is uncertain, so that it is hard to assess the social benefits of implementing some diluted form of Ramsey pricing. Nevertheless, an implementation as for instance described in problem IV may be the only realistic option for Ramsey-like price controls, given the regulatory limitations that are in place. The reason is that among the markets identified as having higher potential for competition problems in the Commission Recommendation on relevant product and service markets, only three markets related to mobile telephony are identified: access and call origination, voice call

[236] Note that call and network externalities can be common in telecommunications markets and could be a rationale for regulation, even if we had several facility-based providers of all sorts of services. The new regulatory framework in the EU seems to consider those issues not worthy of regulation (e.g., nothing can be done without a finding of dominance) and that could be a reasonable judgement call – one can never really prove that the costs of regulation would be lower (or higher) than the market failure it would try correct.

[237] See also ACCC (2004) and the discussion of Gans and King (2004) therein: "There is no reason to suspect mobile network competition for subscribers will lead to socially-optimal Ramsey prices." (p. 170).

termination on individual networks, and the national market for international roaming services, all of them wholesale markets. Hence the regulatory framework does not lend itself well to socially optimal regulation of retail prices, for the Framework Directive states that remedies can only be applied if dominance is established. It seems, however, unlikely that a lack of effective competition will be established in the mobile retail market.

5.4 Concluding remarks

Ignoring, in sections 5.1 and 5.2, welfare issues related to the recovery of investment costs, we have seen that mobile access mark-ups, in general, tend to distort welfare. Fixed consumers make less calls because they face higher prices for F2M calls, and a large part of their potential surplus is captured by the mobile sectors. If competition between mobile operators is more intense, a larger part of this surplus is transfered to mobile subscribers through lower subscription fees and handset subsidies. The theoretical results and simulations discussed in those sections left at least two important issues untouched. First, they did not address the recovery of fixed and common costs of networks (see below). Second, they were oblivious to the large asymmetry between termination access prices charged by fixed operators (which are typically regulated) and mobile operators. The consequence of this asymmetry is a substantial transfer of wealth from the fixed to the mobile sector, which could be prevented by repairing the asymmetry. The latter issue will be addressed in the next chapter. With regard to cost recovery, we have seen in section 5.3 that it is unclear whether (and perhaps even unlikely that) mobile termination charges will include substantial mark-ups in a situation of Ramsey pricing. If a competition authority or regulator wants to implement price controls as a remedy for call termination monopolies, it is crucial that the optimal level of access prices of both fixed and mobile operators are carefully analyzed within an overall framework of welfare maximization.

6 Welfare and remedies

Given what we learned in the previous chapter, what are the policy implications with regard to potential remedies to deal with call termination monopolies? Is a remedy needed in the first place, in the sense that it would lead to an increase in welfare? What type of remedy could be most effective, if any?

Using the insights of the previous chapters, in this chapter we focus on the welfare effects of call termination monopolies and discuss potential remedies. Ths chapter is organized as follows. Section 6.1 gives a general overview of potential welfare effects. Section 6.2 discusses structural remedies that are more or less straightforward: eliminating the asymmetry between the fixed and the mobile sector (subsection 6.2.1), changing from ‘calling party pays’ (CPP) to ‘receiving party pays’ (RPP; subsection 6.2.2), and implemeting the technical remedy of ‘call termination bypass’ (subsection 6.2.3). Section 6.3 revisits access prices regulation and cost recovery, which was the topic of section 5.3. Section 6.4 concludes the chapter.

6.1 Welfare effects in general

In the member states of the EU, it is up to competition authorities and national regulatory authorities (NRAs) to assess if mobile termination leads to a competition problem (access prices above the 'competitive level') with adverse effects on retail markets (e.g. high end-user prices for F2M and possibly also off-net M2M calls). The Independent Regulators Group (IRG) defines the competitive level of access prices as the level that would be set if the wholesale market for call termination was effectively competitive. In particular,

> "In an effectively competitive market, excessive margins are competed away and prices driven down to the efficient level of cost plus a sustainable margin."
> (IRG, 2004, p. 17.)

As a side remark, note that it is unclear what exactly is meant by the 'efficient level of cost plus a sustainable margin', and there is no background information on the underlying notion of welfare, which may be absent or, at best, imprecise.[238] Policy makers, competition authorities and regulators actually quite often refer to the 'competitive level' of prices, without making precise what they mean. Is there a meaningful way to define the competitive level of access prices? In this chapter we will discuss the notion of 'call termination bypass', a technical way of making competition feasible. This technological solution, which is, in principal, feasible, may provide a useful reference point for competitive prices. Another reference point may be provided by considering a situation of RPP (receiving party pays), in which mobile subscribers pay a price for the incoming part of calls that they receive.[239] Although it is impossible to know the extent to which

[238] See also subsection 3.1.2, in which we discussed the policy objectives of the EU regulatory framework. For economic analysis, the main handicap of such general notions is that they do not specify exactly which consumers are taken into account, and according to which weights (if there are different groups of consumers). See also Pijnacker Hordijk and De Vries (2002).

[239] More generally, by RPP we mean that the price for receiving calls is not a priori fixed at zero because of some convention, while the calling party still pays a price for call originiation.

call termination bypass or RPP would reduce access prices, in principle it is possible to use these situations as starting points for the determination of competitive access prices. Presumably they would lead to prices that are significantly below currently observed levels, and perhaps (but this is more speculative) even close to 'cost-based' levels. It is outside the scope of this report to fill in these details, but regulatory interventions that aim at 'restoring' competitive levels, an example of which is provided by access price regulation, should be based on quantified information about prices and cost levels.

Recall that even if any excess profits from termination access are competed away in the retail market, one should worry about access mark-ups. This is because even under intense competition, welfare distortions of access mark-ups may be present, and it is important to take them into account.[240] Clearly, call termination monopolies transfer wealth from fixed users to mobile operators (and indirectly to mobile customers if these revenues are competed away), while distorting the number of calls that are made (especially by fixed users).[241] Accordingly, call termination monopolies lead to distortions, and the question is whether, in a second-best world, there are other welfare effects that compensate for these distortions. It is therefore useful to look at the welfare effects in more detail.

On the one hand, one can distinguish several, potentially distortionary effects from excessive access prices. First, note that the producer of a final product (say the fixed operator) would in principle like to substitute other inputs for an input (the termination access service) that is priced too high. This producer, however, cannot circumvent buying call termination and will have to translate the incurred cost to prices paid by end-users. The indirect effect is therefore that there is too little consumption of the end-services that use call termination as a wholesale input, in particular fixed-to-mobile and (to a lesser

[240] As we have seen in various models discussed in chapter 5, the extent to which access revenues are competed away depends not only on the intensity of competition, but also on the nature of price competition (linear prices versus two-part tariffs).

[241] The numerical results in chapter 5 gave an indication of the relative order of magnitude of these distortions in a stylized model.

extent) off-net mobile-to-mobile voice telephony. In addition, possibly there is too much consumption of the mobile products and services that are subsidized by the access revenues, in particular mobile subscriptions or handsets. Offering free handsets may lead to 'excess momentum', consisting of an inefficiently high turnover of phones by consumers and excessive investments in the development of handset technology. Another distortionary effect (that may occur if the market does not function well) is that mobile operators may partly use the access revenues to finance superfluous sales and marketing activities. Also, consumers' calling behavior may be distorted away from fixed telephony towards mobile telephony, in order to benefit from the fact that calls originating at a mobile network are relatively cheap (e.g. because fixed termination access is regulated, so that per-minute prices of mobile-to-fixed calls are not inflated).[242]

On the other hand, access prices above marginal costs may also have positive welfare effects. In the economic models discussed in the previous subsections, the fixed and common costs of networks, and more generally network investments, were ignored. Therefore, a typical outcome of welfare analysis is that socially optimal access prices are typically equal to marginal costs (depending on the assumptions; see ch. 5). A relevant question is, however, to what extent access revenues should be used to recover fixed and common costs of the existing network.[243] In the presence of such costs, it may be optimal to set access prices above marginal cost levels. Hence, a first possible contribution to welfare is that access mark-ups may contribute to the recovery of fixed and common costs. Note that this argument not only applies to mobile operators, but also to fixed operators, whose networks (i) have required investments of a high order of magnitude (presumably higher than those needed for the rollout of mobile networks), and (ii)

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[242] See also *Wholesale Mobile Voice Call Termination*, Statement by Ofcom, 1 June 2004. Not all of these effects are equally concinving, though.

[243] It is sometimes argued that access revenues are needed to finance next-generation network investments. In the UK, for instance, some 2G operators claimed that these revenues are necessary for the roll-out of 3G. The latter claim can be readily dismissed. Even though from a strategy viewpoint, operators cannot separate 2G and 3G, the business case for 3G should not depend on excessive profits from another, existing technology, but on its own merits.

depreciate slowly.[244] [245]It should be noted, though, that a large part of the investments by fixed operators (laying the cables) was done long ago, so they may have been largely amortized by now.

Second, since access mark-ups lead to reduced mobile subscription fees and prices of handsets, they contribute to the expansion of the mobile market. Fixed callers, who can then reach more mobile subscribers, benefit from a larger mobile market. Accordingly, it may be desirable that the expansion of the mobile market is indirectly subsidized by fixed customers. However, it should be noted that this argument is losing its relevance as the mobile market has matured and penetration growth rates have gone down.[246] Note, however, that saturation per se may not be the critical variable: lower access charges leading to higher fixed fees may, in theory, push subscribers to leave mobile networks. In practice, one may wonder whether that will occur (e.g., people who received free handsets financed by access revenues will not drop out).

A potentially positive effect of mobile access mark-ups on welfare is, furthermore, that equipment manufacturers indirectly benefit from access mark-ups, since their products are subsidized by mobile operators. In theory, one can imagine that this can help them to

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[244] Fixed networks depreciate presumably slower than mobile networks, as progress typically does not occur through new generations, such as GSM and UMTS in mobile telephony, but through network improvements, maintenance and datacompression over existing connections. In particular, the introduction of technologies such as ADSL can be seen as a paradigm shift that boosts the value of the fixed network.

[245] On the other hand, if fixed network assets depreciate more slowly, mark-ups can be lower as there is a longer horizon for cost recovery.

[246] The EU average penetration rate in 2003 was 80.9%, and the EU average penetration growth rate (2002-2003) was 6%. The growth rate has been levelling off. Hence it will probably take just a couple of years for the average market to achieve its saturation point. Some penetration and growth rates for specific countries include: Germany penetration 75% and growth 7%, Netherlands penetration 75% and growth 2%, United Kingdom penetration 85% and growth 6% (EC, 2003b).

overcome barriers to attract capital needed for R&D, but this type of reasoning requires the presence of imperfections on the capital market. It also requires that one cares about subsidizing R&D related to handsets relatively more than R&D on other dimensions of telecommunications services.[247]

Access mark-ups also have redistributive consequences, which should not be neglected. The most significant one is probably the cross-subsidy from the fixed to the mobile sector. This effect on fixed customers may be offset by the fact that most fixed customers also own a mobile phone, so that overall they may hardly be affected. But there may always be a group of consumers owning a fixed telephone but no mobile, who are worse off because of inflated fixed-to-mobile per-minute prices while they miss the benefit of reduced subscription fees for mobiles. In the UK, for instance, the group for whom this is the case is substantial (12% of households) and consists mainly of lower-income consumers.[248] Is regulation needed to protect this segment, which is probably decreasing in size, or should these consumers be induced (perhaps through a subsidy) to buy a mobile phone so that they can bypass the fixed-to-mobile connection? Redistributive policy goals are perhaps better implemented through tax and expenditure policies (at the central government level), rather than being carried out through sector-specific intervention. In any case one can question the desirability of heavy-handed intervention to deal with this aspect of the problem, which is limited and shrinking.

Without a full-fledged empirical analysis of welfare effects, it is hard to assess whether the distortions caused by call termination monopolies are substantial. At present, we know very little about the size of welfare distortions. Crandall and Sidak (2004) cite a witness statement by Professor James Mirrlees (University of Cambridge):

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[247] Moreover, it requires that handset manufacturers are either operating in a perfectly competitive market (so that innovation would benefit consumers) or that they are not located abroad.

[248] *Wholesale Mobile Voice Call Termination*, Statement by Ofcom, 1 June 2004, p. 31-32.

> "[...] the welfare gains that could be realized by a move toward regulation of mobile call termination rates are modest at best. Mirrlees estimates that the annual welfare increase would be roughly one-tenth the size of the benefits upon which the U.K.'s Competition Commission relied in justifying its price cap on mobile termination rates (£4.7 million versus £54.5 million)"
> (Crandall and Sidak, 2004, p. 4).

The difference between the welfare estimations pointed out by Mirrlees is explained by the fact that lower access prices will lead to increases in other prices charged by mobile operators, tempering the demand for mobile subscriptions. In any case, it is clear that our current knowledge about the size of welfare effects is rather limited, while existing estimations may not be reliable.[249] Littlechild (2004) argues that since in the current situation (which is characterized by access mark-ups and transfers of benefits to mobile consumers) there are beneficial as well as detrimental effects, policy makers should not only be concerned with decreasing the detriments. They should also make a comparison with the reduced benefits (or the costs) caused by regulatory intervention. A crucial point is that it makes sense to first consider options that are less intrusive than price controls. The following section (6.2) discusses three such possibilities. We will come back to access price regulation later (section 6.3).

[249] The simulation model of section 5.2 can deliver reasonable estimates of welfare effects, if calibrated with realistic cost and demand data.

6.2 Structural remedies

In this section, we assume that F2M access prices are indeed too high and we focus on ways (other than direct price controls) in which regulators can bring them closer to welfare-optimal levels. The remedies we consider here are not ruled out by the regulatory framework in the EU (see chapter 3), but nevertheless have hardly received explicit, prominent attention in policy discussions.[250] For instance, in ERG (2004), only the standard remedies (transparency, non-discrimination, accounting separation, access, price control and cost accounting) are discussed, while it is mentioned that NRAs are allowed by the Access Directive to impose other remedies as well (in 'exceptional circumstances'), and that those are not covered by the document. Here, we discuss remedies without trying to (artificially) fit them into the set of standard remedies.[251]

We discuss one-shot interventions that may create a fundamental change in the market which, if successful, may make heavy-handed regulation of access prices unnecessary. One way of intervening is to change from CPP to RPP, and another way is to directly introduce competition for call termination by making it technically feasible that alternative mobile operators can deliver calls to other operators' customers ('call termination bypass'). These options will be discussed in turn, but first, we consider the simple remedy of repairing a bargaining asymmetry between fixed and mobile operators.

[250] More generally, the analytical underpinnings of different types of remedies is an underdeveloped area in policy discussions (Larouche, 2004).

[251] A discussion of the feasibility of implementing the remedies that we discuss is outside of the scope of this report. In principle, the EU regulatory framework allows for them.

6.2.1 Eliminating the asymmetry between the fixed and the mobile sector

The possibility that we describe here is rather preliminary, more meant to be an eye-opener than a serious contender. At present, there are large asymmetries between termination access prices charged by fixed operators, who are typically regulated at cost-based levels, and mobile operators, who do not face such constraints. A straightforward idea to tackle the problem of call termination monopolies is to eliminate this asymmetry. This idea can be implemented in several ways. An obvious one is, for instance by deregulating fixed operators' access prices or by enforcing reciprocity of access charges, to give them the capability (i.e., the power to commit) to retaliate to access mark-ups charged by mobile operators. Such a capability could prevent mobile operators from charging high access prices in the first place, being afraid of retaliation by the fixed operator. Nevertheless, as operators typically have unilateral incentives to increase their own access price, it could happen that all access prices (i.e., not only those charged by mobile operators) would end up at inflated levels. Facing little competitive pressure, the fixed operator would have no incentives to pass the access revenues on to its customers, unless forced to do so by retail price regulation.

It is worthwhile to explore this type of option in more detail, in order to gain a better understanding of its potential consequences, both in theory and in practice.[252] In practice, this solution does not have good chances of being adopted. This is because the same regulatory frameworks that are biased to use price controls to deal with call termination monopolies, are unlikely to loosen the grip on fixed operators as long as their competitive positions are still strong (in particular, as long as they still have dominant positions).

An additional consideration when implementing this type of option is that the regulator should verify that access mark-ups, if they still occur, affect consumers to the smallest

[252] A difficulty with this option is that bilateral negotiations in combination with reciprocal access charges may be problematic in practice, because the marginal costs of access of fixed and mobile operators are asymmetric.

extent possible. A way to do that is to enforce that the fixed operator's revenues from call termination are passed on to its customers, for instance by imposing a global price cap on fixed operators' fixed and wholesale prices. More direct is to adapt the levels of the fixed operators' regulated retail prices in accordance with the level of access revenues (higher access revenues should translate into reduced retail prices).

It should be stressed that given our current knowledge, it is uncertain that this remedy will work. Nevertheless, it is straightforward to implement, certainly in comparison with imposing price controls on mobile operators. The next subsection discusses a remedy that is almost equally straightforward, but with the added benefit that there is much less doubt about its effectivity.

6.2.2 Changing from CPP to RPP

Because the application of CPP ('calling party pays') is a central cause of monopoly power in call termination markets, a comparison with RPP ('receiving party pays') should get prominent attention in discussions on remedies.[253] Unfortunately, this is not the case, as policy makers give much more attention to price controls.

RPP does *not* mean that the calling party does not pay at all. Neither does it automatically mean that receiving calls is costly – it only means that the price for receiving calls (the 'reception charge' or 'receive price') is not a priori fixed at zero because of some convention in the market. Also, the calling party still pays a price for call originiation.[254] Accordingly, RPP actually means that the caller and called party share the cost of a call,

[253] RPP is known as MPP ('mobile party pays') in the US.

[254] Note that in principle, operators may decide to offer these services for free. For instance, if reception charges are set at zero, while call origination prices are positive, a situation of RPP effectively coincides with CPP.

where the balance of cost sharing is endogenously determined in accordance with the prices set by operators.

Note that CPP and RPP are nothing more than commercial arrangements with customers. A major advantage of RPP is that it remedies the distortions of call termination monopolies, and consequently, it makes price controls unnecessary (Doyle and Smith, 1998, Littlechild, 2004, and see also section 5.1 on the model adaptation of Armstrong, 2002). RPP encourages mobile operators to compete for call termination, a service which is part of the bundle purchased by mobile end-users (the salient difference with a CPP regime). Thus mobile termation charges would be subject to competitive (downward) pressure. In the US, for example, the average mobile access price in 2002 was equal to $ 0.005, roughly the size of the average fixed access price, compared to an average mobile access charge of $ 0.16 in Europe.[255] Marcus (2004) argues that RPP is an important element that contributes to lower mobile prices per minute of use, but it must be understood in the broader context in the US. Nevertheless, RPP does not give rise to call termination monopolies, while CPP does.

A welfare effect of RPP that has recently received some attention is related to the efficiency of calls (see Littlechild, 2004, for an informal discussion, and see section 5.1 for papers based on formal models). Define the net value of a call as the utility derived from the call minus its price. Note that for any payment regime, a call that is made will always create net value for the calling and the called party.[256] If not, the call would not take place, as it could be 'vetoed' by either party. However, if the caller derives a lot of value from a certain call but the called party doesn't, then RPP may prevent a call that would create positive aggregate value from happening. Similarly, CPP can lead to an

[255] According to the *Eight Annual Report* by the FCC, cited in Crandall and Sidak (2004, p. 16). It must be noted that in the US, mobile operators are allowed to charge a reciprocal access price to compensate for the incremental cost of call termination.

[256] Ignore the nuisance from receiving an unwanted call that is terminated immediately. Such disutilities can be avoided if handsets display the number of the calling party, or simply charging callers only for the first few seconds of every call.

efficiency loss when the called party highly values a certain call while the caller doesn't. It will be hard to empirically estimate these types of efficiency effects of RPP and CPP. Nevertheless, some conclusions can be drawn without empirical data. Recall that CPP puts the financial burden – which is inflated because of call termination monopolies – completely on the calling party, while RPP leads to a split of the charges incurred by consumers. Even though this split need not be exactly in proportion to the underlying costs of call origination and termination, it is likely to lead to a smaller number of 'unoccurring' calls that would create aggregate value if they were made. Also, the split of the financial burden is unlikely to be distorted by underlying market failures, as in the case of CPP. Hence, from a welfare viewpoint, RPP may lead to superior results. The main reason is that RPP supports the internalization of call externalities that occur when subscribers positively value receiving calls.

Section 5.1 contained a discussion of some recent theoretical papers on the welfare effects of RPP. Let us recall here that various recent papers show that positive reception charges can improve welfare (in terms of the efficiency of calls). Since this result is obtained under specific assumptions, for instance related to the decision to make a call or to wait until one is being called, there is no guarantee that this would occur in reality. Nevertheless, it seems safe to say that RPP is unlikely to harm welfare, to formulate it carefully.

Implementing RPP has some disadvantages, however. Of course, there is an implementation cost. Since a change to RPP is a discrete, one-time only event, requiring adaptations in the system that handle information about customers, calls and billing, the implementation cost should not be a major concern, compared to the costs of more heavy-handed interventions. Another objection to RPP, also of transitory nature, is the fact that consumers will have to get used to a new way of charging for calls, and that some of them (e.g. those without fixed telephones) may dislike a system of RPP. Overall, the disruption from changing to RPP does not seem to pose a heavy burden.

A potential disadvantage of RPP, which is worrysome at least at first sight, is that mobile users may switch off their handsets, and also keep their phone numbers secret, in order to avoid being charged for incoming calls. These are legitimate concerns, but unfortunately it is hard to empirically assess the size of such effects.[257] Experience in the US, however, suggests that mobile subscribers in an RPP regime use their phones much more often than users in CPP regimes.[258] It should be noted that it is not just RPP, but also the introduction of 'bucket plans' (i.e. charging a flat fee for a certain number of call minutes, which are purchased in advance by customers) by mobile operators to encourage their subscribers to use their phones more often, that led to higher minutes of use per subscriber. Before the diffusion of bucket-plans, apparently it was common to avoid giving out mobile phone numbers. Nevertheless, the introduction of innovative price structures endogenously depends on the RPP regime. Therefore it seems that the risk that mobile users switch off their phones is mostly theoretical.

As argued by Doyle and Smith (1998) and Littlechild (2004), compared to implementing price controls (which will be discussed in the next section), a change to RPP seems to be superior.[259] It is like curing a disease rather than eliminating the symptoms. Not only does it lead to the desired effects (elimination of distortive prices, elimination of cross-subsidies from the fixed to the mobile sector), it reaches these effects without prolonged and intrusive interfering in the market.[260]

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[257] See Littlechild (2004) for brief discussions of several case studies in developing countries.

[258] See a discussion of empirical data in Crandall and Sidak (2004) and Marcus (2004).

[259] To the best of our knowledge, there are no legal impediments for EU member states to switch from CPP to RPP.

[260] It is hard to understand why it has not been selected among other candidate remedies by Oftel and the Competition Commission in the UK. Littlechild (2004) cites an interesting statement made by Oftel in 2002: "In Oftel's view, existing mobile users would react strongly against having to pay to receive calls. Oftel would have a hard job explaining that overall it was in their interests to pay for such calls when previously they received them for free. Oftel believes that MNOs would also be likely to criticise the changes, lobby against them, and blame the CC and Oftel for their introduction. The political outfall would be considerable" (p. 18).

Mobile operators would probably have to be forced to switch to RPP-based commercial arrangements with their customers. Given the (apparently) high revenues from call termination on their networks, they are unlikely to be in a hurry. According to Wright (2002), mobile operators will probably never choose to implement RPP if mobile termination charges are unregulated. Hence it may be necessary to mandate a switch to RPP for all operators. Can this be done in a simple way? An indirect way of doing this (which requires further consideration for policy purposes) is to regulate mobile termination charges at zero.[261] This type of price control requires neither cost monitoring by the regulator nor adjustments over time (as in the case of RPI–x price caps); hence it is very simple to implement, something which cannot be said about price controls in general. By doing so, mobile operators at once lose all their access revenues. Having lost their funds to cross-subsidize mobile retail prices, they will then have strong incentives to rebalance their retail prices, which may lead to a positive reception charge.[262]

6.2.3 Call termination bypass

An interesting remedy is to change the technological architecture of mobile telecommunications networks, in order to create the possibility of competition in call termination.[263] Imagine that the caller (or alternatively, the caller's network operator who bargains on behalf of its customers) can decide to bypass the called party's network, and instead select an alternative operator to deliver the call. If such an additional choice were feasible, alternative operators would have the ability to compete in the call termination market.

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[261] See also Wright (2002). See adaptation 1 of the benchmark model in section 5.1.

[262] In principle, nothing prevents them from charging nothing for receiving calls. But if the termination access charge is fixed at zero, then in any case retail prices for call origination will not be inflated due to high access charges.

[263] Valletti (2003) also discusses this type of solution.

Some background is useful in order to consider this remedy in more detail. What exactly is it that a consumer buys when subscribing to a mobile operator? In return for a subscription fee, the mobile user typically purchases a bundle consisting of:

1. a SIM card corresponding to a unique telephone number, possibly in combination with a mobile handset;
2. the ability to make calls which are charged at certain per-minute prices, depending on the type of call (possibly including a given number of free call minutes);
3. the ability to receive calls, which are charged in a regime of RPP but not under CPP; and
4. the ability to use various other services, which are usually charged, such as voicemail, international roaming, the ability to send and receive short message services (SMS) or more advanced multimedia services.

An element of the subscription contract is that only the operator to which a consumer subscribes (i.e., the operator that provides the SIM card) is able to terminate calls to that consumer. Suppose, for instance, that a customer subscribes to mobile operator *A*. The switches of the networks are programmed such that when a call originating from a subscriber to some other network needs to be delivered to the customer on network *A*, this is automatically done by operator *A*'s network and antennas. By default, bypass of call termination is impossible. Suppose, however, that there is another operator, *B*, with the same network coverage as operator *A*. In principle, the antennas of network *B* are also able to communicate with the handset of the subscriber to network *A*; in fact they pick up signals from all phones that are switched on within its coverage area. Except for the way the networks have been programmed and mobile services are being bundled, in principle there is nothing to prevent operator *B* from bypassing operator *A*, that is, from terminating the call to network *A*'s subscriber. This type of 'call termination bypass'

could, for example, take place on the request of the calling party (e.g. by dialling a 'Carrier Select' prefix on a per-call basis).[264]

Note that call termination bypass is not equivalent to the option of introducing multiple SIM cards, a remedy discussed in Valletti (2003). A multiple SIM card allows the mobile subscriber to switch between different networks. Hence, the main difference is that multiple SIM cards put the choice in the hands of the receiver, whereas call termination bypass puts the choice in the hands of the caller. Clearly, the effectiveness of multiple SIM cards remedy will be greater under RPP than under CPP, since the ability to switch may not be exercised in practice if it has no financial consequences. Call termination bypass, however, empowers the caller, who bears the financial burden of calling under CPP, to decide which network terminates his or her call. Therefore it is likely to be much more effective than the introduction of multiple SIM cards.

Is call termination bypass feasible from a technical viewpoint? To allow alternative operators to deliver calls to other operators' customers, two adaptations in mobile network architecture are needed:[265]

1. Operators' HLRs (the databases containing information about their subscribers; see ch. 2) need to be adapted.
2. The 'attach procedure', which is the procedure according to which mobile users' handsets virtually 'attach' themselves to a network, needs to be changed.

Apparently, these adaptations can be implemented with the current generation of handsets, so that mobile users do not need to purchase new handsets.[266] However, this

[264] It would be interesting to incorporate call termination bypass in the models analyzed in chapter 5. Due to time restrictions, we have not been able to perform this analysis. Nevertheless, if callers are well informed about access prices and face little hassle when they choose to use the bypass option, clearly mobile operators will face strong downward pressure on the access price.

[265] We are grateful to Jan van Loon (TNO Telecom, Delft) for providing the necessary background information.

type of solution is not very practical because a mobile phone can only be attached to a single network at a time.[267] In particular, if an alternative operator wants to deliver a call to a mobile user, the handset first needs (to be forced) to switch to that operator's network (this would be carried out by the revised attach procedure). The main practical barrier is that the switching process would take time, in the order of magnitude of 10 seconds, comparable to the time lag between turning on a handset and the connection with a network. Assuming that consumers would dislike such a delay, the implementation of call termination bypass does not seem to be an attractive option, at least at present. Nevertheless, current R&D in mobile telecommunications includes 'access network selection', which focuses for instance the possibility of automatically switching to a wireless local area network ('WLAN') when an employee enters the premises of the company where he or she works. The remedy of call termination bypass could easily fit into this type of research program. Within a couple of years, such solutions can become reality. Moreover, it is not unlikely that the attach procedure will become faster in the near future. Hence the practical barrier mentioned above may then cease to exist.

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[266] Most mobile users have so-called 'phase 2' handsets, which can handle the network adaptations described above.

[267] This is not the case for 'dual mode' handsets, which are not commonly used.

6.3 Socially optimal regulation of access prices

In practice, the behavioral remedy of price controls, in particular regulation of mobile termination charges, tends to push these prices towards cost-based levels. The reason is that the narrowly defined markets (call termination on single networks – see chapter 4) give rise to dominant positions (100% market shares) and hence a substantial risk of abuse (i.e., high mark-ups). This policy approach is questionable because it is uncertain that cost-based access prices are in consumers' interest or maximize welfare.

An important issue in the debate is the need to recover fixed and common costs. Falch (1997) provides estimates of investment-related costs in (presumably fixed) telecoms that vary between 60 and 90 percent of the costs of production, consisting of investments in terminal equipment, access networks, switching, transmission/long line, and other facilities (buildings etc.). The numbers are probably lower for mobile telecommunications, for instance, the component 'access' exhibits fundamentally different characteristics in mobile telecoms, as there is no need to roll out physical local connections. Nevertheless the investments in mobile telecoms are likely to be quite substantial.

According to the Access Directive of the EC, national regulatory authorities have to take into account the investments by operators, if they conclude that access price regulation is the most appropriate intervention. The question is how this should be done. Although prices that are fixed at cost-based levels may include a sufficiently high 'reasonable return', they tend to ignore efficiency considerations with regard to the allocation of the burden of cost recovery. The reason is that they are not based on the maximization of total welfare, contrary to Ramsey prices. By definition, Ramsey pricing (i.e., a proper implementation and not just adopting Ramsey-style elements in price controls) maximize welfare under the restriction that operators break even (see section 5.3). The resulting outcome was denoted as a second-best welfare outcome.

Within the context of mobile call termination, Ramsey pricing is more complex than is commonly thought. An important observation in section 5.3 was that Ramsey pricing should jointly be applied to the mobile sector and the fixed sector, since these sectors form a closely integrated (read: interconnected) system characterized by call traffic flows and wholesale payments between them. These interactions form the heart of the call termination problem. Given the prominent presence of fixed and common costs in the fixed sector, just as Ramsey pricing in the mobile sector might imply that the fixed sector partly finances the costs of mobile networks, a reverse subsidy may also be socially desirable.

To assess the claim that Ramsey pricing will lead to mobile access mark-ups, consider the following observation by Valletti (2003):

> "No Ramsey mark-up is required when demand for mobile subscriptions is totally inelastic in which case all fixed and common costs should be recovered via monthly rental fees, without inducing any additional distortion."
> (Valletti, 2003, p. 25).

In reality, telephony has become virtually indispensable in order to participate in society (most users probably cannot miss them if prices stay within a reasonable range), so that the assumption of inelastic demand for connections (whether fixed or mobile) does not seem to be wide off the mark.[268] Hence, suppose that the price elasticity for subscriptions is relatively low compared to the elasticities of metered services such as calling. Ignoring for a moment the possibility that handsets are subsidized through access revenues, if

[268] Some existing empirical studies, which are based on relatively old data (approx. the second half of the 1990s to 2001), show that the demand for subscriptions is elastic, but relatively low (Competition Commission, 2002, ch. 8). Different studies do not lead to the same rankings of elasticities, however, which makes one wonder about the reliability of these studies (CC, 2002, contains a critical discussion). Note that given the rapid development of the mobile market, it is unlikely that data which are mainly from the late 1990s can accurately describe the demand characteristics of the current situation of a mature mobile market.

competition in the retail market is not too intense, mark-ups in subscription fees may then constitute a feasible and efficient way to recover fixed and common costs without distorting consumers' choices and calling behavior.[269] However, if mobile operators set access prices above marginal cost levels, intense retail competition will force them to use the resulting access revenues to lower subscription fees. Accordingly, access mark-ups may undermine the potential for cost-recoupment of other, possibly more effective instruments, in particular subscription fees. This tension is usually not taken into account in policy discussions, although it puts access mark-ups in a different light – the claim that Ramsey pricing automatically leads to mobile access mark-ups is not as convincing as it may seem at first sight.

The central lesson from section 5.3 was that optimizing over a small set of prices (mobile termination charges), while ignoring prices in the fixed sector and mobile retail prices, is unlikely to lead to the second-best welfare outcome. Nevertheless, a partial implementation of Ramsey elements (e.g., only regulating mobile termination charges) may be the only realistic option, given that among the markets identified as having higher potential for competition problems in the Commission Recommendation on relevant product and service markets, only three markets related to mobile telephony are identified (access and call origination, voice call termination on individual networks, and the national market for international roaming services, all of them wholesale markets). We repeat the observation from chapter 5 that since the Framework Directive states that remedies can only be applied if dominance is established, the regulatory framework in the EU does not lend itself well to socially optimal regulation of retail prices.

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[269] Within the context of the models analyzed in the previous chapter, mark-ups in subscription fees (and setting all other prices, including termination charges, at marginal, or perceived marginal, costs) would be optimal, since the demand for subscriptions was assumed to be inelastic. Nevertheless, one would want to analyze a more general model with elastic demand for subscriptions as well as substitution between fixed and mobile subscriptions. A possible outcome of such an analysis is that all prices will include some mark-ups, although subscription fees will, presumably, bear the heaviest weight.

In addition to the regulatory constraints that limit the effectiveness of price controls to obtain a second-best welfare outcome, there are some practical considerations to take into account. Implementing some elements of Ramsey pricing may not be immediately feasible, as it requires very detailed demand data about all types of elasticities. Although there have been attempts to estimate elasticities and derive implications for Ramsey prices in mobile telecommunications, at present the resulting estimates do not provide sufficient grounds for implementing price controls based on Ramsey considerations (Newbery, 2004). There is little data available and the existing data does not seem to be sufficiently accurate or robust.[270] Obtaining useful data is rather complex and requires sophisticated techniques – operators themselves are not likely to have such detailed data available for their own pricing strategies.[271] As Elliot (2004) and Newbery (2004) argue, such difficulties should not prevent regulators from learning to gather sound data and improve the methodology and techniques that are needed. In addition, we have seen above that Ramsey pricing requires a careful, joint consideration of the fixed and mobile sector, as well as a reorientation of regulation of the fixed operator towards an overall Ramsey pricing structure. As a side remark, note that the demands on the fixed operator need not become heavier by doing so, for one will only have to adapt prices that are already regulated to Ramsey levels.

The conclusion is that regulation in the form of price controls, aiming at an efficient recovery of operators' fixed and common costs, requires careful reflection, to put it mildly. Partial, Ramsey-style price controls cannot be assumed to lead to an overall Ramsey pricing structure. Whether the resulting pricing structure requires substantial mark-ups in mobile access prices is an open question, since they undermine the effectiveness of cost recovery through alternative, potentially superior instruments, such as subscription fees.

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[270] Elliot (2004) claims that current empirical data is sufficiently reliable to make judgments for regulatory investigations. However, he also writes that currently available data may not be robust.

[271] Private communication with mobile operators.

6.4 Concluding remarks on remedies

An important observation of the previous section is that the telecommunications sector is plagued by more than problems of market power alone (e.g. natural monopoly, essential facilities, call termination monopolies). In particular, externalities (call externalities, network externalities) are common and may provide a rationale for regulation, even if there are several facility-based providers of all sorts of services that compete effectively.[272] As nothing, or hardly anything, can be done without a finding of dominance, the new regulatory framework in the EU seems to consider those issues not worthy of regulation. That might be a reasonable judgement call, since one can never really prove that the costs of regulation would be lower (or higher) than the market failure it would try correct. Nevertheless, it is important to point out that the problem of call termination monopolies should not merely be seen, from the narrow context of the relevant market, as a problem of market power, but rather from a broader context as a market failure caused by externalities. Based on this observation, it is natural to look beyond remedies that deal with symptoms of monopoly power (price controls in particular), and take more structural remedies into consideration as well. Moreover, the standard list of remedies of the regulatory framework (see chapter 3) does not seem to be set up in order to deal with the type of market failure that we are facing here. None of those remedies, except for price controls, seems to have the power to do something about call termination monopolies. As this list is non-exhaustive, regulators are able to look beyond it.

An economic analysis of mobile call termination must take into account the connections between the fixed and the mobile sector, and also between the wholesale and retail level. At present, there are large asymmetries between termination access prices charged by fixed operators (who are typically regulated) and mobile operators. Thus a straightforward way of tackling the problem of call termination monopolies may be to

[272] See e.g. the arguments made in Larouche (2000, ch. 4).

eliminate the regulatory asymmetry between the two sectors, and verify that fixed end-users benefit from access mark-ups through reduced retail prices. This type of remedy, which was discussed in subsection 6.2.1, merits further exploration, at least to shed more light on the backgrounds of call termination monopolies.

Also, given the prominent presence of fixed and common costs in the fixed sector, Ramsey pricing, if pursued, should be applied at an overall level to the fixed and mobile market. A possible outcome of such an exercise is that fixed operators should increase their termination access charges, so that mobile users contribute to cost recovery in the fixed sector. However, besides the large scale of such an exercise, controlling access prices may turn out to be a semi-permanent phenomenon, rather than a one-shot intervention that creates a fundamental change in the market.

Major drawbacks of access regulation (through price controls) are that it is heavy-handed, and that it is transitory only to the extent that regulators will have to continuously monitor whether the 'single network' market definition has ceased to be valid, and if yes, withdraw the price controls. Without a full-fledged analysis of welfare effects, it is hard to assess whether the problems and distortions caused by call termination monopolies are sufficiently substantial to warrant regulatory intervention. In any case, rather than jumping to heavy-handed measures (such as imposing price controls) in the mobile market, it makes sense to consider less intrusive options – that may happen to be more structural.

Fortunately such alternatives exist, with the added benefit that they eliminate the root cause of the welfare distortion and hence make access regulation unnecessary. One way to do this is to make operators charge called parties for the termination part of a call, while calling parties pay for other 'parts' of the call (RPP). This remedy can probably be implemented straightaway, but must probably be enforced through regulatory pressure. Another option is introduce call termination bypass, that is, competition for call termination by making it feasible that alternative mobile operators can deliver calls to other operators' customers (on the explicit request of calling parties, for instance by

dialling a 'Carrier Select' prefix). The option may require further technological progress to make it fully effective and acceptable, as an implementing based on current technology is somewhat disruptive, introduces a nuisance for customers making calls to mobile users, and may require regulatory oversight to guarantee effective access to call termination.

The legal implications of the structural remedies that we proposed deserve more attention (e.g., given the regulatory framework, are there undesirable biases towards certain remedies, and are there different ways to implement a certain remedies?). As an example, let us mention the current discussion on 'interoperability', which can loosely be defined as the establishment of end-to-end connections between end-users.[273] In the Netherlands and in the UK, telecommunications authorities are currently investigating to what extent interoperability, a vague notion which features prominently in telecoms legislations, can be used as a guiding principle to deal with a whole range of market and competition issues.[274] For instance, in conflicts on wholesale tariffs (such as mobile access prices), the notion of interoperability might help to establish pricing principles, in addition to, or perhaps as a substitute for, price controls that deal with abuses of market power. A more general issue is whether interoperability can also have implications on CPP versus RPP, or more technical implications, in particular on the implementation of call termination bypass.

[273] See Verbon (2004).

[274] The results of the consultations are meant to serve as input for the European Commission, in order to obtain principles of implementation and best practices for all member states of the EU. See "Consultatiedocument Interoperabiliteit", OPTA/IBT/2004/201834, 1 October 2004.

7. Conclusion

Market research by competition authorities in countries with CPP ('calling party pays') regimes indicates that wholesale call termination on a single mobile network can be defined as a relevant product market, and on such a market, an operator has 100% market share. Mobile operators face no (or very little) competitive pressure in the wholesale market for call termination.

The root cause of these 'call termination monopolies' is the CPP regime, which gives rise to an externality: mobile operators can charge operators in the fixed market – instead of charging customers in the market in which they compete – for the termination of incoming calls from fixed subscribers. Fixed operators' access charges are usually regulated (at 'cost-oriented' levels) so that they do not have countervailing bargaining power in the wholesale market for termination access.

Intense (or even perfect) competition in the mobile retail market does not provide a reason to conclude that the call termination monopolies can be ignored by regulators and competition authorities. Even if termination profits are passed on to mobile customers (in the case of perfect competition: up to the point where each operator makes zero overall profits), welfare may be distorted.

Mark-ups in mobile access prices stemming from call termination monopolies tend to inflate per-minute prices for off-net calls, especially for fixed-to-mobile (F2M) calls. This distortionary effect on retail prices is more severe when fixed and mobile markets are more 'distinct', that is, when there is a larger number of fixed users who are not customers in the mobile market but do make calls to mobile users. Therefore mobile access mark-ups effectively create a net money stream from the fixed to the mobile sector, subsidized by fixed subscribers who call mobile users. The problem in the mobile-to-mobile (M2M) case tends to be less severe, since the effects of access mark-ups cancel out to some extent (in a more symmetric market, charging each other for call termination

makes much less sense, since access mark-ups would only lead to pumping around access revenues).

The presence of call termination monopolies does not automatically imply that there is an overall welfare problem. On the one hand, (i) per-minute prices for F2M and off-net M2M calls are inflated, distorting the demand for these calls; and (ii) consumers who pay inflated prices subsidize consumers who benefit from handset subsidies or reduced mobile subscription fees, so that there may be overconsumption of mobile services (e.g. an inefficiently high turnover of phones by consumers). On the other hand, (i) access mark-ups may efficiently contribute to the recovery of fixed and common costs; and (ii) assuming that competition in the mobile retail market is sufficiently effective, mobile consumers benefit since overall mobile telephony becomes cheaper, an effect that contributes to fast market expansion. The net welfare effect is unknown (and hard to assess).

If operators have to recover fixed and common costs of their networks, then Ramsey pricing (by definition) leads to a second-best welfare outcome (compared to the first-best outcome in which investments are covered by a lump-sum transfer from the government). A proper welfare analysis to derive Ramsey prices should include both the fixed and mobile market, each of them both at the retail and wholesale level. Whether the resulting pricing structure requires substantial mark-ups in mobile access prices is uncertain, in particular since they undermine the effectiveness of cost recovery through alternative, potentially superior instruments, such as subscription fees. Moreover, partial price controls with Ramsey elements (e.g. setting only mobile access prices but not fixed access prices at Ramsey levels, or leaving retail prices to be determined by competition) may not lead to a second-best welfare outcome.

The current policy tendency is to restrict attention to the defined market, establish substantial market power (a dominant position), and regulate the prices in question. A shortcoming of this approach is that it is not based on an overall welfare analysis. Also, it is transitory only to the extent that regulators will have to continuously monitor whether

the ‘single network’ market definition has ceased to be valid, and if yes, withdraw the price controls. Thus a possible consequence is that regulatory intervention becomes a semi-permanent phenomenon, rather than a one-shot intervention that creates a fundamental change in the market. Overall, the strong focus on price controls that is observed in practice is hard to justify from a welfare perspective.

Compared to price controls, there exist alternative, less heavy-handed, ways to intervene, which are directly aiming at the root cause of the problem and can make access regulation unnecessary.

First, as an eye-opener, consider the elimination of the regulatory asymmetry between the fixed and mobile sector, for instance by creating countervailing bargaining power for the fixed operator in the wholesale access market (while verifying that fixed end-users benefit from lower access mark-ups through reduced retail prices). Although this type of remedy may ultimately not be be feasible as regulators may be unwilling to deregulate fixed termination access, it points at the connections between the fixed and mobile sectors in relation to call termination monopolies.

Second, a remedy is to introduce RPP (‘receiving party pays’), that is, change the commercial agreements such that the price for receiving calls is not a priori fixed at zero because of some convention, while the calling party still pays a price for call originiation. This remedy can be implemented straightaway but requires regulatory intervention (to make it happen).

Third, an option is to introduce ‘call termination bypass’ by making it technically feasible that alternative mobile operators can deliver calls to other operators’ customers (e.g. on the explicit request of calling parties, for instance by dialling a ‘Carrier Select’ prefix). The latter solution may not be immediately feasible or desirable though, given the current state of network technology.

Remedies should always be compared to the possibility of refraining from intervention. Arguments in favor of laissez-faire are: (i) the cross-subsidy from the fixed to the mobile sector, which might be the most significant effect of call termination monopolies, are offset by the fact that most fixed customers also own a mobile phone, so that overall they may hardly be affected; (ii) changes will not lead to Pareto-improvements, as users and/or operators in the mobile sector will lose, regardless of the way in which F2M termination tariffs are reduced; (iii) mobile operators paid money for their licenses, arguably on the expectation that they could recover (part of) it with F2M termination charges – changing the rules of the game could be considered a regulatory taking; (iv) we do not yet have a good understanding of how CPP versus RPP may affect social interactions and how the two regimes are valued by consumers; and (v) call termination termination may become viable in a few years, so there is no need to introduce structural reforms now. Perhaps except for the first one, these arguments are not very strong: (ii) one cannot realistically expect Pareto-improvements to be a requirement for regulatory intervention; (iii) even though regulatory takings may pose a serious risk for firms, licence-holders can realistically expect that competition authorities and regulators are 'obliged' to deal with major market failures; (iv) the potential negative effects of a switch to RPP seem to be of minor importance; and (v) without external pressure, operators will not have incentives to develop the technology for call termination bypass.

The net welfare effect of access mark-ups due to call termination monopolies is unknown, but clearly call behavior is distorted as a result of inflated per-minute prices for off-net calls. If any, forcing mobile operators to apply RPP instead of CPP is a straightforward and simple remedy, as it instantaneously eliminates the root cause of call termination monopolies.[275] The current focus on price controls to deal with call

[275] Recall that we framed the central question within the context of second-generation mobile networks (2G). Nevertheless, the insights that were obtained are also relevant for the next generation based on UMTS. In a CPP regime, and with similar regulatory asymmetries between the fixed and mobile sectors as in the current situation, 3G mobile telephony will also suffer from call termination monopolies. Our observation that implementing a regime of RPP is superior (because of practical reasons) to the remedy of call termination bypass, may no longer be valid if

termination monopolies is understandable within the context of the regulatory framework in the EU, but it ignores important elements of the broader picture and therefore risks to be misguided from a welfare viewpoint. Such an approach may eliminate the symptoms at a local level (namely within the narrowly defined market where an abuse of market power is established), but it lacks a welfare diagnosis that looks at the root cause of the problem, which happens to be an externality that goes beyond the 'relevant' market of wholesale call termination on a single mobile network.

By adopting a welfare perspective, and keeping some distance from the regulatory framework's possibilities and limitations, we have been able to address call termination monopolies more fundamentally than it is usually done in policy and legal arenas. An implication of our approach is that the legal implications of the structural remedies that we proposed deserve more attention. We observed that regulatory frameworks may be biased towards remedies that do not (necessarily) maximize welfare, as they may be dealing with incorrectly speficied problems. A more general lesson of our analysis is, therefore, that regulatory authorities should try to avoid myopic regulatory policies, even if this implies that they have to reason outside of the scope of the most accessible legal instruments at their disposal. If existing regulatory instruments are not suited to deal with a certain problem, it is important to point this out so that the legal framework can be adapted accordingly.

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technological progress happens to result in a different architecture of 3G networks, allowing for a straightforward configuration of technical bypass.

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